

# Acupoint Embedding: Mechanisms, Applications, and Safety of a Novel Acupuncture Technique

## Abstract

Acupuncture, a cornerstone of Traditional Chinese Medicine (TCM), has been practiced for millennia in the treatment of various ailments. Acupoint embedding (AEM), also known as catgut embedding, represents a modern evolution of this ancient practice. AEM involves the insertion of absorbable threads, typically catgut or surgical sutures, into specific acupoints to provide continuous stimulation. This method offers a convenient alternative to frequent manual acupuncture (MA) sessions, potentially enhancing therapeutic efficacy and patient satisfaction. While AEM shares many indications with MA, including pain management, weight loss, and inflammation reduction, it also carries potential adverse effects such as subcutaneous indurations and bleeding. This review explores the current literature on AEM, examining its methodology, mechanisms of action, clinical applications, safety profile, and future directions.

## 1. Introduction

Acupuncture, a core component of TCM, is a non-pharmacological therapeutic system that has witnessed a surge in global acceptance among both patients and healthcare providers [1]. Originating in China thousands of years ago, acupuncture's reach extended to Europe and the United States by the 16th century [2]. Rooted in meridian theory, acupuncture involves the insertion of fine needles into specific acupoints distributed across the body [1]. TCM views health as a state of balanced "Qi," or vital energy, essential for organ function [3]. Despite its growing popularity, knowledge gaps persist regarding acupuncture's diverse methods, therapeutic benefits, indications, safety, and precautions [4]. A cross-sectional study in the United States revealed that pain relief, particularly for conditions like lower back pain,

headaches, and shoulder pain, was the primary motivation for seeking acupuncture treatment. Other prevalent reasons included mental health concerns (anxiety, depression, insomnia), musculoskeletal issues (arthritis, frozen shoulder), immune system support, gynecological problems (infertility), and gastrointestinal disorders (constipation) [3].

Over time, acupuncture has evolved to encompass various modalities, including electroacupuncture, laser acupuncture, herbal acupuncture, and embedding. AEM, a specialized form of acupuncture, involves the insertion of catgut or surgical threads into acupoints to provide continuous stimulation [5]. Recent research has highlighted the diverse applications of AEM in managing conditions such as menopause, urticaria, depression, obesity, acute and chronic pain, with a relatively low risk of side effects [1, 5, 6]. Given the increasing interest in AEM and the need for a comprehensive resource, this review aims to provide a concise overview of its methods, comparison with MA, indications, contraindications, mechanisms of action, and safety profile.

## 2. Methods and Thread Types

AEM involves the insertion of small segments of absorbable threads into specific acupoints based on the patient's condition and TCM syndrome differentiation. The embedded threads induce localized inflammation, providing continuous stimulation to the acupoint, akin to a retained acupuncture needle [7]. In a typical AEM session, approximately twenty 1-2 cm sterile threads are loaded into disposable 20-21 gauge stainless steel needles. After disinfecting the target acupoints, the needles are inserted, and the threads are advanced into the subcutaneous tissue using a blunt needle. The needles are then withdrawn, leaving the threads embedded. This procedure is generally repeated every 3-4 weeks for at least 2 months to achieve optimal therapeutic outcomes [8].

While AEM originated in China, its adoption in other countries like South Korea, Mexico, and Indonesia has not led to significant variations in the technique [9-12]. Three primary types of embedding threads are utilized:

- **Natural threads:** These include collagen-based threads, such as sheep catgut derived from the small intestine, and chitosan threads derived from chitin found in crustacean

shells and insect exoskeletons. Catgut, while widely used historically, has a higher risk of allergic reactions and often requires chromic acid treatment to improve flexibility [13]. Chitosan, on the other hand, exhibits excellent biocompatibility and minimal immunogenicity [13]. A study by Wang et al. [15] demonstrated that chitosan embedding resulted in fewer side effects and greater therapeutic efficacy compared to catgut.

- **Synthetic threads:** Polylactic acid-glycolic acid (PLGA) and polydioxanone (PDO) are commonly used synthetic polymers for AEM. PLGA, synthesized from plant-derived lactic and glycolic acid, is a biodegradable polymer widely used in biomedical applications [13]. PDO sutures offer high biocompatibility and tensile strength. Compared to catgut, both PLGA and PDO have been associated with fewer adverse events such as tenderness, induration, and swelling [13].
- **Bioactive threads:** These threads incorporate additional components to enhance therapeutic effects. Antimicrobial threads, such as those containing triclosan or antimicrobial peptides, aim to reduce the risk of infection [13, 16]. Silver nanoparticle-coated threads offer anti-inflammatory properties and promote tissue repair [17]. Additionally, sustained-release threads have been developed to deliver drugs at a controlled rate, potentially improving treatment efficacy and reducing the frequency of AEM sessions [13, 18].

### **3. Similarities and Differences of AEM with MA**

AEM is particularly well-suited for individuals who face challenges with attending frequent MA sessions due to time constraints, limited mobility, or lack of access to qualified practitioners. It also offers a convenient option for medical tourists. Several studies have compared the efficacy and safety of AEM and MA. While both modalities have demonstrated clinical benefits, AEM has shown superiority in some studies [9, 19, 20]. In terms of safety, both MA and AEM can cause mild adverse events such as tenderness, redness, and bleeding, with a potentially higher incidence in AEM [2, 19]. However, more rigorous studies are needed to draw definitive conclusions.

### **4. Indications and Contraindications**

AEM largely shares its indications and contraindications with MA. It can be considered for conditions where MA has shown efficacy, acting as a form of semi-permanent acupuncture. While the psychological benefits of acupuncture, including AEM and sham acupuncture, are acknowledged, the effectiveness of AEM remains contingent on the practitioner's skill and expertise [1].

Key therapeutic applications of AEM include:

- **Weight management:** AEM has shown promise in treating obesity [7, 21].
- **Pain management:** AEM is used to manage various pain conditions, including musculoskeletal pain [5, 23].
- **Inflammation reduction:** AEM can help alleviate inflammation in conditions such as peptic ulcer [6, 22].
- **Gynecological and reproductive health:** AEM has been explored for infertility [24] and menopausal symptoms [25].

Similar to MA, AEM has certain contraindications:

- **Pregnancy and pediatrics:** AEM is generally avoided in pregnant women and children.
- **Active infection or skin lesions:** AEM should not be performed on infected skin or in the presence of skin malignancies.
- **Bleeding disorders:** Caution is advised in patients with bleeding disorders.
- **Mental health conditions:** AEM may not be suitable for individuals with certain mental health conditions.

Studies from Korea, Mexico, and Indonesia have further expanded the evidence base for AEM:

- **Korea:** AEM has shown positive effects in managing neck pain [27] and carpal tunnel syndrome [11].
- **Mexico:** AEM has demonstrated antidepressant effects in animal models [12, 28] and has been associated with a reduced risk of diabetes in obese women [9, 29].

- **Indonesia:** AEM has been explored for its potential benefits in essential hypertension [30] and obesity [10, 31]. However, a study by Fitri et al. [32] found no significant effect of AEM on interleukin-6 levels in patients with gastroesophageal reflux disease.

## 5. Mechanism of Action

AEM's mechanism of action is multifaceted, combining the principles of acupuncture with the sustained stimulation provided by the embedded threads. While research in this area is ongoing, several mechanisms have been proposed:

- **Continuous bio-stimulation:** The retained threads provide prolonged stimulation to the acupoints, potentially leading to more sustained therapeutic effects [23, 24].
- **Immune modulation:** The introduction of the thread, particularly catgut, can trigger a mild immune response, potentially enhancing macrophage activity and immune function [5].
- **Inflammation reduction:** AEM can promote local vasodilation, improve blood and lymphatic circulation, and reduce inflammation [5].
- **Pain management:** AEM may stimulate the release of endogenous opioids and neuropeptides, raising the pain threshold and inhibiting pain signals [5, 22].
- **Muscle pain relief:** The slow hydrolysis of the thread may promote collagen synthesis and provide continuous stimulation to muscles and ligaments [23].
- **Weight management:** AEM may influence weight loss by improving insulin sensitivity, leptin resistance, and potentially modulating gut microbiota [6, 9, 26].
- **Appetite control:** AEM may regulate neurotransmitters involved in appetite control, leading to increased satiety and reduced hunger [9].
- **Osteoporosis prevention:** AEM may help prevent osteoporosis by regulating the hypothalamic-pituitary-ovarian axis and increasing estrogen levels [25].

## 6. Mechanism According to TCM

AEM is viewed as a refinement of MA, offering comparable therapeutic benefits with reduced treatment frequency and cost [7, 19]. The embedded threads provide a continuous, gentle stimulation to the acupoints, mimicking the effects of prolonged needle retention [5,

7, 23]. The gradual degradation of the thread by proteolytic enzymes and macrophages further prolongs acupoint stimulation [9].

AEM is considered a holistic therapy that integrates various TCM principles, including acupoint sealing, acupuncture stimulation, and blood pricking. By stimulating acupoints, AEM aims to regulate the flow of Qi, balance Yin and Yang, and restore harmony within the body [5, 9].

## 7. Side Effects

While AEM is generally considered safe, it is essential to acknowledge potential adverse effects associated with thread insertion.

- **Local reactions:** The most common side effects are localized reactions at the insertion site, including subcutaneous indurations, redness, swelling, bleeding, bruising, and pain [19, 33, 35]. These reactions are typically mild and resolve spontaneously.
- **Infection:** Although rare, there is a potential risk of infection associated with any procedure that involves skin penetration [23].
- **Foreign body reactions:** Catgut, being a natural protein, can elicit foreign body reactions, leading to increased temperature, redness, rash, itching, or nodule formation [13]. Synthetic threads like PDO are less likely to cause such reactions [23].
- **Rare adverse events:** In rare cases, more severe adverse events such as epilepsy, irregular menstruation, skin ulcers, and thread malabsorption have been reported [35]. However, the causal relationship between these events and AEM is not always clear.

A randomized controlled trial by Lee et al. [23] found no evidence of infection in participants receiving AEM for chronic low back pain over a 10-week period. However, long-term safety data is still limited.

To minimize the risk of adverse events, it is crucial to ensure proper hygiene, use sterile techniques, select appropriate thread materials, and monitor patients closely.

## 8. Conclusion

AEM offers a promising approach to acupuncture therapy, providing continuous acupoint stimulation and potentially enhancing therapeutic outcomes. While research continues to elucidate its mechanisms of action and long-term safety profile, current evidence suggests that AEM is a relatively safe and convenient option, particularly with the use of modern absorbable surgical sutures. Further research, including large-scale randomized controlled trials, is needed to definitively establish its efficacy and safety across various conditions.

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