Medicine Insights

Review

Research Progress on the Application of Myofascial Trigger Point Theory in Acupuncture Therapy

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Abstract: The myofascial trigger point (MTrP) theory, originally developed within modern Western medicine, shares notable conceptual similarities with traditional medical frameworks, highlighting the interconnectedness of muscular and fascial systems in the generation of pain. MTrPs are recognized as common etiological factors contributing to a wide range of clinical pain conditions, including musculoskeletal disorders, tension-type headaches, and myofascial pain syndromes. In recent years, this theory has received increasing attention both in research and clinical practice, as understanding the mechanisms underlying MTrPs can inform more precise and effective treatment strategies. Acupuncture, a widely employed therapeutic modality in both Eastern and Western medical contexts, has demonstrated consistent efficacy in alleviating pain associated with MTrPs. The practice is thought to modulate local and systemic pain pathways through neurophysiological, biochemical, and mechanical mechanisms. Clinical studies have increasingly explored the integration of MTrP theory into acupuncture practice, investigating its impact on treatment outcomes, optimization of acupoint selection, and individualized therapeutic approaches. This paper provides a systematic review of the current research progress on the clinical application of MTrP theory in acupuncture therapy. Special attention is given to its therapeutic value, underlying mechanisms, and the potential for improving pain management strategies in diverse patient populations. By synthesizing available evidence, the review aims to inform clinicians and researchers about the practical significance of combining MTrP insights with acupuncture, and to highlight future directions for research and clinical practice.

Keywords: myofascial trigger point; acupuncture therapy; electroacupuncture; warm needling moxibustion; clinical application progress

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1. Introduction

The concept of myofascial trigger points (MTrPs) was first systematically introduced in the 1940s [1]. According to modern medical theory, MTrPs are hyperirritable loci within muscle fibers, often characterized by palpable taut bands or nodules beneath the skin. Manual palpation of these sites can reproduce pain responses, which in severe cases may progress to myofascial pain syndrome (MPS) [2].

From the perspective of traditional Chinese medicine (TCM), the theory of MTrPs closely corresponds to the doctrine of "jingjin bing" and the pathological phenomenon of "jinjie" (tendon knots). Chinese Myology of Meridians and Collaterals (Zhongguo Jingjin Xue) notes that overstrain or injury of tendons, muscles, or joints may disrupt the circulation of qi and blood, as well as impair information transmission. Consequently, subtle substances in the twelve jingjin (sinew meridians) tend to accumulate at regions with abundant musculature or near joints, leading to the formation of jinjie [3]. Manual stimulation of these tendon knots often induces sensations such as soreness, numbness, or distending pain.

This paper aims to provide a systematic exposition of MTrP theory from both Western and TCM perspectives, encompassing its pathological features, underlying mechanisms, and clinical applications in acupuncture. By integrating insights from modern biomedical and traditional theoretical frameworks, this study seeks to offer a broader theoretical foundation for the application of acupuncture in pain management.

2. Overview of MTrPs

MTrPs are defined as discrete, hyperirritable nodules located within taut bands of skeletal muscle fibers and are regarded as a principal source of various forms of myogenic pain [4]. They are typically classified into two categories: active trigger points and latent trigger points [5]. Active trigger points are characterized by persistent spontaneous pain, often eliciting a local twitch response (LTR) upon needling, accompanied by pronounced referred pain. In contrast, latent trigger points evoke pain only upon manual compression, yet they similarly exhibit features such as taut bands and LTR [6]. Under certain conditions-including overuse, trauma, or degenerative changes-latent trigger points may transform into active ones.

MTrPs are nearly ubiquitous across skeletal muscle tissues [7]. In the early stages, they generally do not provoke continuous pain in the absence of mechanical stimulation. However, repeated exposure to predisposing factors such as inflammation, impaired immunity, trauma, common cold, upper respiratory tract infection, or poor posture may activate latent trigger points, converting them into active MTrPs. These can induce severe pain by stimulating nerve endings, giving rise to referred pain and peripheral neurological symptoms. Clinically, patients often present with varying degrees of taut bands around localized tender spots. In severe cases, manifestations may include muscle twitches, fasciculations, weakness, restricted joint mobility, or even visceral dysfunctions such as palpitations, chest tightness, dyspepsia, urinary frequency, or urgency [8].

2.1. Diagnosis of Myofascial Trigger Points (MTrPs)

The diagnostic criteria for MTrPs remain largely subjective. Musculoskeletal ultrasonography has emerged as an important modality for MTrP detection. Both grayscale ultrasound and elastography can be applied in clinical assessment. Grayscale ultrasound distinguishes MTrPs from surrounding healthy muscle tissue based on echo intensity, with hypoechoic signals typically observed in regions of edema or hyperemia, and hyperechoic signals appearing in cases of fatty infiltration [9]. Elastography techniques, including strain elastography (SE), acoustic radiation force impulse imaging (ARFI), and shear wave elastography (SWE), enable quantitative evaluation of muscle stiffness by measuring tissue elasticity (Young's modulus) and shear wave velocity (SWV), providing objective evidence for the presence of MTrPs [10].

Electromyography (EMG) is another valuable diagnostic tool that records electrical activity within skeletal muscles. In patients with MTrPs, EMG often reveals abnormal neurotransmitter release and localized endplate potentials, which are closely correlated with active MTrPs. Such abnormal electrical activity results in alterations in both mean frequency and amplitude of muscle signals. In the resting state, active MTrPs frequently display increased EMG amplitude, reflecting muscle stiffness and spasm [11].

Considerable interindividual variability-including differences in age, sex, body mass index (BMI), and muscle contraction state-can influence the activation and clinical manifestation of MTrPs. Thus, although ultrasonography and EMG provide useful diagnostic evidence, both methods carry inherent limitations and should be interpreted with caution.

2.2. Pathological Mechanisms of Myofascial Trigger Points (MTrPs)

Modern biomedical research indicates that under the influence of factors such as trauma, cold-damp invasion, or overuse, dysfunction of the neuromuscular endplate occurs. This dysfunction leads to excessive release of acetylcholine, inducing sustained opening of Ca^{2+} channels on the postsynaptic membrane, resulting in continuous muscle contraction and the formation of nodules or taut bands [12]. Such persistent contraction contributes to the accumulation of metabolic by-products and an increased oxygen demand, creating a localized ischemic and hypermetabolic state [13].

Metabolite accumulation stimulates nociceptors and simultaneously promotes the release of inflammatory mediators, including serotonin, histamine, bradykinin, and tumor necrosis factor-α (TNF-α). This process establishes a positive feedback loop between acetylcholine release and inflammatory factors [14]. Prolonged continuation of this cycle may lead to biomechanical imbalance around joints, producing compensatory alterations in synergistic and antagonistic muscle groups, ultimately perpetuating a vicious cycle (see Figure 1).

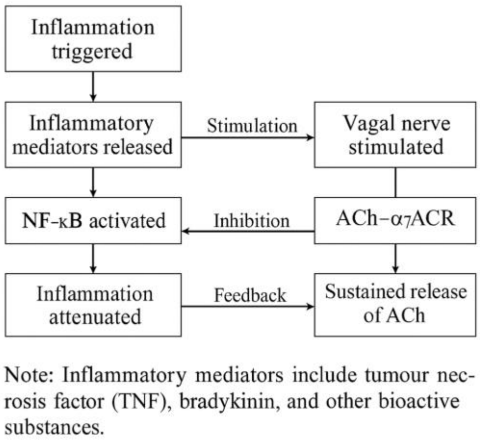

Figure 1. Acetylcholine release-inflammatory mediator positive feedback loop.

3. The Relationship among Ashi Points, Jin Jie, and Myofascial Trigger Points (MTrPs)

In traditional Chinese medicine (TCM), the concepts of MTrPs, Ashi Points, and Jin Jie (tendon knots) are closely interrelated. Jin Jie refers to nodular aggregations distributed along the sinew meridians. It is considered a complex structure composed of soft tissues such as muscles, fascia, and nerves, functioning to connect bones, protect internal organs, and regulate the circulation of qi and blood. It also serves as a pathway for the movement of defensive qi. In clinical practice, the principle of "selecting points based on tenderness" (yi tong wei shu) is frequently applied [16].

According to TCM theory, the pathological development of Jin Jie generally progresses through three stages: the initial stage, characterized by "pain due to accumulation"; the middle stage, marked by "congestion and spasm"; and the late stage, in which "cross-linked lesions" are formed. Repeated cycles of soft tissue injury and repair can lead to pathological exudation and fibrous tissue hyperplasia, eventually resulting in cross-linked adhesions that obstruct meridian flow and develop into refractory Jin Jie lesions [17].

The Qianjin Yaofang by Sun Simiao documents Ashi Points as reactive sites identified through palpation, rather than as specific, fixed anatomical locations. These points emerge from meridian obstruction and impaired circulation of qi and blood, leading to insufficient nourishment of muscles, tendons, and bones. Clinically, Ashi Points manifest as localized tenderness without referred pain to internal organs, reflecting the body's underlying pathological condition [18].

A comparison between Jin Jie and Ashi Points is shown in Table 1. Both exhibit tenderness upon palpation; however, they differ in distribution and therapeutic approach. Jin Jie lesions are typically treated based on the principle of "selecting points according to pain" and are mostly distributed at the distal ends of the twelve sinew meridians. During treatment, patients often experience a pulling sensation associated with the affected region, and therapeutic methods such as tendon-relaxing and knot-dispelling techniques are employed. In contrast, Ashi Points are selected based on the principle "where there is pain, there is the point", without fixed anatomical distribution, and are generally managed with simple needling for pain relief.

Table 1. *Comparison between Jin Jie and Ashi Points.*

Feature	Jin Jie	Ashi Points
Point selection principle	Based on tenderness (*yi tong wei shu*)	"Where there is pain, there is the point" (*ji de bian kuai, ji yun ashi*)
Distribution	Distal ends of the twelve meridians	Distributed throughout the body
Therapeutic approach	Tendon-relaxing and knot-dispelling to relieve pain	Simple needling for analgesia

The theories of Ashi Points and Jin Jie in TCM demonstrate notable similarities with modern biomedical concepts of MTrPs. In all three, local tenderness serves as a key diagnostic indicator. At present, there is no unified international diagnostic standard for MTrPs, and palpation remains the primary method for clinical identification. Patients typically present with tenderness, referred pain, and restricted mobility. Additional diagnostic tools, such as ultrasonography and electromyography, can assist in detection.

MTrPs are most commonly distributed within the muscle belly or at the musculotendinous junction of the affected muscle, often producing radiating pain. Therapeutic interventions primarily include dry needling and wet needling. In comparison, Ashi Points and Jin Jie are usually diagnosed through palpation, presenting as localized tenderness without extensive radiation, and are frequently treated with warm needling or electroacupuncture techniques.

4. Clinical Application of Acupuncture Techniques in the Treatment of Myofascial Trigger Points (MTrPs)

The clinical application of acupuncture in the management of MTrPs can be broadly divided into two categories: (1) traditional medical therapies, including warm needling moxibustion, electroacupuncture, fire needling, thread embedding, and small needle-knife therapy; and (2) invasive treatments developed within modern medicine, including dry needling, wet needling, and drug injection.

4.1. Traditional Medical Therapies

4.1.1. Warm Needling Moxibustion

Moxibustion exerts therapeutic effects such as warming the meridians, dispelling cold, reinforcing yang, promoting the circulation of qi and blood, guiding pathogenic heat outward, and eliminating dampness. Warm needling moxibustion combines acupuncture with burning moxa to deliver heat deep into spastic muscle tissues. This stimulation activates local nerve fibers, promotes vasodilation, accelerates blood flow, reduces the exudation of inflammatory and algesic substances, and enhances their absorption, thereby relieving pain [19]. By regulating the neuro-humoral system, it facilitates the clearance of metabolic by-products, decreases inflammation, and achieves the effects of warming the meridians, activating collaterals, and alleviating muscle pain.

4.1.2. Electroacupuncture

Electroacupuncture integrates traditional acupuncture with modern electrotherapy. By applying electrical currents of varying frequencies and intensities through filiform needles, electrical stimulation is transmitted directly to MTrP-positive sites. Electroacupuncture typically employs three stimulation waveforms: continuous, intermittent, and dense-disperse [20]. Among these, dense-disperse waves produce stronger analgesic effects, enhance lymphatic circulation, improve tissue metabolism, and are often used to relieve local edema and spasm in MTrPs. Continuous waves, due to their monotonous pattern, may lead to muscle adaptation and are therefore less commonly used. Intermittent waves alternately stimulate tissues, effectively exciting neuromuscular structures, and are frequently applied during the later stages of MTrPs when muscle atrophy and weakness are evident.

4.1.3. Fire Needling

Fire needling, historically referred to as fan zhen or zhuo ci, was first recorded in Lingshu・Guan Zhen as an effective treatment for bi syndrome. In this technique, a filiform needle is heated until red-hot and then quickly inserted into the tense region of the fascia before immediate withdrawal, followed by compression with sterile cotton. Within the TCM framework, MTrPs are classified under bi syndrome, often attributed to insufficiency of vital qi, deficiency of the liver and kidneys, and invasion of pathogenic wind, cold, or dampness [21]. Fire needling combines the mechanical stimulation of acupuncture with the warming effects of moxibustion, thereby tonifying yang to treat deficiency syndromes and opening the interstices to expel pathogens. It is widely used for cold-type muscular and tendinous disorders and may be complemented by local massage to further relieve pain and stiffness.

4.1.4. Thread Embedding Therapy

Thread embedding therapy involves inserting absorbable surgical catgut into MTrPs using a specialized needle, targeting tender nodules or taut bands that elicit local twitch responses. The embedded thread gradually softens and is absorbed within the tissue, providing prolonged and continuous stimulation compared with conventional acupuncture [22]. In the initial phase, it helps to regulate excessive yin-yang imbalance of the viscera; in the later phase, it supplements deficiencies, thus promoting yin-yang equilibrium. Thread embedding has been shown to alleviate myofascial inflammation in the lumbar and dorsal regions, release fascial tension, restore meridian balance, and deactivate MTrP-positive sites [23].

4.1.5. Small Needle-Knife Therapy

Small needle-knife therapy integrates the manual principles of TCM acupuncture with minimally invasive surgical techniques. It is primarily used to release tissue adhesions and stimulate local muscle fibers [24]. This method reduces excessive muscle tension, restores coordination between agonistic and antagonistic muscle groups, and enhances local blood circulation. The strong mechanical stimulation during release induces capillary dilation, improves nutrient supply, and relaxes spastic muscle fibers. Additionally, it promotes the secretion of vasoactive substances and accelerates the clearance of inflammatory mediators such as bradykinin and serotonin, thereby reducing serum levels of pain-inducing substances and contributing to the inactivation of MTrP-positive sites [25].

4.2. Invasive Treatments in Modern Medicine

4.2.1. Dry Needling

Dry needling refers to the insertion of fine filiform needles into trigger points without the use of local anesthetics. Mechanical stimulation of these points increases local capillary circulation, accelerates the removal of pain-inducing substances, and directly deactivates trigger points, thereby enhancing the body's tolerance to pain. This technique also stimulates peripheral nerve fibers to release neurotransmitters and promotes the secretion of bioactive substances such as bradykinin, calcitonin gene-related peptide (CGRP), and substance P. Together, these biochemical reactions alleviate muscle pain, reduce involuntary contractions, and facilitate functional recovery [26].

4.2.2. Wet Needling

Wet needling involves inserting a 0.4 mm injection needle into MTrPs. When muscle twitching, spasm, or sharp pain is elicited, an appropriate amount of lidocaine is injected locally, often combined with stretching exercises, for conditions such as lateral epicondylitis (tennis elbow) [27]. After injection, muscle pain is rapidly reduced and muscle strength restored. Due to its stronger mechanical stimulation, wet needling not only disrupts tense muscle fibers but also stimulates sensory pathways in the spinal cord, further relaxing the muscles. Clinical studies have demonstrated that wet needling may produce better therapeutic outcomes than dry needling in relieving symptoms such as dizziness associated with myofascial pain, particularly through rebalancing abnormal muscle tension. In addition, therapeutic agents such as ozone or corticosteroids can be administered following local anesthesia to reduce inflammation, alleviate nerve compression or irritation, and relieve pain and functional impairment [28].

5. Conclusion

As a key theoretical framework for clinical pain management, the concept of myofascial trigger points (MTrPs), although rooted in Western medicine, shares notable conceptual parallels with the traditional Chinese medicine (TCM) notions of *Jin Jie* and *Ashi* points. These two medical paradigms demonstrate complementarity and convergence in their understanding of disease mechanisms, clinical manifestations, and therapeutic strategies. From the modern biomedical perspective, MTrPs are associated with pathophysiological alterations such as motor endplate dysfunction, excessive acetylcholine release, and inflammatory mediator cascades. In contrast, TCM explains these phenomena through the holistic principles of *qi* and blood circulation, meridian conduction, and stagnation leading to local obstruction or "knots." Together, these perspectives establish a multidimensional theoretical foundation for clinical application, effectively bridging microscopic physiological mechanisms with macroscopic systemic regulation.

In clinical practice, dry needling primarily interrupts the pathological pain cycle through targeted mechanical stimulation at the motor endplate, whereas acupuncture modulates meridian pathways to promote the smooth flow of *qi* and blood. Evidence from clinical research suggests that integrative approaches combining Chinese and Western medical techniques often produce enhanced outcomes, particularly in managing chronic or refractory myofascial pain.

Future research should further strengthen the theoretical and clinical framework in several key areas:

(1) Basic research: Further exploration of the molecular and cellular mechanisms underlying both MTrPs and TCM concepts such as *Jin Jie*, with the goal of identifying shared biomarkers and establishing mechanistic correlations.

(2) Diagnostic standards: Development of objective, quantifiable diagnostic methods that integrate the strengths of both medical systems to support more precise clinical classification and differential diagnosis.

(3) Therapeutic optimisation: Implementation of large-scale, randomised controlled clinical trials to evaluate the efficacy, indications, and standardisation of acupuncture-related interventions in MTrP management.

(4) Mechanistic investigation: Application of advanced neuroimaging and electrophysiological technologies to elucidate neural signal transduction pathways and regulatory networks involved in acupuncture treatment.

(5) Clinical translation: Establishment of standardised, evidence-based integrative treatment protocols and clinical guidelines to promote broader adoption and reproducibility in medical practice.

In summary, with the ongoing development of integrative medicine, research on MTrPs represents an important frontier in pain management. By bridging traditional theoretical models and modern biomedical science, it holds great promise for advancing both the understanding and clinical effectiveness of acupuncture-based therapies in contemporary healthcare.

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