



Dry Needling And The Kinetic Chain: A Narrative Review Of Chain-Based Interventions In Chronic Pain

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Abstract

Chronic musculoskeletal pain often involves dysfunction not isolated to a single region but distributed along interconnected movement chains. The kinetic chain concept borrowed from biomechanics, views the body as linked segments (joints and muscles) whose coordinated function influences whole-body movement. In parallel, fascial chains or myofascial meridians (e.g., the Superficial Back Line) represent continuous connective-tissue pathways that transmit tension and link distant muscles. This narrative review explores how dry needling (DN) might act along these chains to relieve chronic pain. We discuss theoretical mechanisms whereby needling one muscle could modulate distant structures and summarize emerging evidence for chain-based needling approaches. Notably, clinical and experimental studies suggest that inserting a needle at a distal site can reduce trigger-point irritability elsewhere. For example, dry needling the forearm extensor relieved neck/upper-trapezius pain, likely via spinal reflexes. Recent human have confirmed remote effects of dry needling in chronic neck pain. Additionally, dry needling has been shown to influence autonomic function positively in fibromyalgia patients. Although no high-quality trials have explicitly tested a chain protocol in chronic pain, preliminary findings imply that augmenting conventional therapy with distal needling may enhance outcomes. We integrate theoretical frameworks and draw parallels with related therapies to outline the rationale for chain-oriented needling. Gaps include the lack of standardized protocols and limited clinical data. We highlight the potential of viewing dry needling within a kinetic-chain model and call for mechanistic and clinical research to validate whether chain-based approaches yield superior pain relief in chronic musculoskeletal conditions.

Keywords: dry needling, kinetic chain, myofascial meridians, chronic pain, fascial chain, trigger point, rehabilitation

Introduction

Chronic musculoskeletal pain often reflects dysfunction beyond a single site ^[1]. Biomechanically, the body is viewed as a series of kinetic chains, linked segments of joints and muscles that transmit force and coordinate movement ^[1]. This perspective implies that an impairment or tightness in one region can influence distant structures, potentially contributing to pain elsewhere ^[1]. The concept of fascial chains or myofascial meridians describes continuous lines of connective tissue and muscle that integrate the musculoskeletal system ^[2]. Anatomical studies have confirmed robust fascial continuity in many such lines ^[3]. Recent dissections have detailed the continuity between fascial layers of the limbs and trunk ^[4], providing strong anatomical support. The human fascial network is a continuous, innervated tissue that transmits mechano-metabolic information throughout the body ^[5]. Mechanoreceptors within fascia provide rich sensory feedback, allowing tension changes at one end of a chain to affect motor tone and proprioception elsewhere ^[5].

Dry needling (DN), the insertion of fine needles into myofascial trigger points is traditionally a local therapy for pain and tightness ^[6]. Its mechanisms include local twitch responses, neuromuscular release, and neuromodulatory effects on the central nervous system ^[6]. However, if muscular and fascial chains indeed link body regions, DN applied at one link could potentially influence another link via neurophysiological or fascial pathways. This review examines the kinetic-chain perspective of DN in chronic pain. We discuss the theoretical basis of chain-based interventions, describe how needling may affect distant structures, review existing evidence for DN acting along chains, and draw on analogous therapies ^[6,7].

Search Strategy

We conducted a comprehensive literature search following the SANRA (Scale for the Assessment of Narrative Review Articles) guidelines. Databases searched included PubMed, Scopus, and Google Scholar up to April 2025. Keywords used were: dry needling, kinetic chain, fascial chain, myofascial meridians, force transmission fascia, chronic pain rehabilitation. We also examined grey literature on related manual therapies. Included were clinical studies, reviews, and conceptual papers addressing cross-segmental or chain-related effects of interventions. Articles focusing solely on unrelated treatments or peripheral topics were excluded. Relevant classic texts were consulted for theoretical context.

Concept of the Kinetic Chain in Human Movement

The kinetic chain concept originates from engineering and sports science, describing how the body's segments act in series or parallel during movement. In a closed kinetic chain, the distal end is fixed (e.g., foot on the ground during squat), causing multiple joints and muscles to co-contract. In an open kinetic chain, the limb is free (e.g., leg extension). Karandikar and Ortiz explained that the kinetic-chain approach "helped us better understand the underlying physiology of human movement" and improved rehabilitation across musculoskeletal conditions ^[1].

Clinical observations, such as how proximal hip weakness can contribute to knee pain or scapular dyskinesis to cervical discomfort, reflect this chain influence ^[1]. Recent studies also suggest kinetic chain dysfunctions play significant roles in chronic musculoskeletal conditions like patellofemoral pain and shoulder impingement syndromes ^[8].

Applying this idea to dry needling implies that needling a distal or proximal muscle connected through the kinetic chain can potentially alter symptoms at the painful region. Hence, integrating dry needling into kinetic-chain thinking could lead to more holistic management strategies for musculoskeletal pain.

Role of Fascial Chains and Myofascial Meridians

Beyond joints, fascia provides continuous lines of force transmission ^[2,3]. Myofascial meridians (e.g., the superficial back line, deep front line, spiral line) map connected muscles enveloped by fascia and aponeuroses ^[2]. Wilke et al. systematically reviewed anatomical studies and found strong evidence supporting fascial continuity along several lines ^[3]. Recent work by Stecco et al. emphasized that fascial tissues form a “tensional network” capable of transmitting mechanical forces between distant body regions ^[9]. Notably, the superficial back line (from the plantar fascia to the occiput) shows verified connective tissue linkage across its major transitions ^[2,3,4].

Fascia is richly innervated with mechanoreceptors such as Golgi tendon organs, Ruffini endings, and Pacinian corpuscles. These sensory structures allow tension at one end of a fascial chain to influence muscle tone and proprioception at distant points ^[5]. A recent study demonstrated that myofascial continuity influences force transmission across the posterior chain even during low-load tasks, reinforcing the idea that fascial chains are clinically significant in movement and rehabilitation ^[11].

Clinically, dysfunctions like pelvic tilts or plantar fasciitis can alter force distribution along the kinetic and fascial chains, affecting more proximal structures such as the lumbar spine or cervical spine ^[3, 4, 12]. Therefore, interventions addressing not just local symptoms but also distant dysfunctions along the fascial chain may enhance rehabilitation outcomes.

Dry Needling: Mechanisms and Effects on Distant Structures

Dry needling disrupts abnormal endplate potentials, improves blood circulation, and reduces nociceptive input at the local tissue level ^[6]. A study demonstrated that dry needling applied to the forearm extensor reduced pain sensitivity in the upper trapezius muscle, suggesting remote neuromodulatory effects ^[6]. Hsieh et al. highlighted that remote effects depend on intact spinal pathways, where needling one muscle can influence distant myofascial structures via reflex arcs ^[13].

An article showed that DN improved heart rate variability and autonomic balance in fibromyalgia patients, further supporting systemic responses to local needling ^[10]. Moreover a study emphasized that dry needling may induce widespread pain inhibition via activation of central pain inhibitory mechanisms ^[14]. Altogether, DN appears to exert local, segmental, and extra-segmental effects through mechanical, neurophysiological, and biochemical pathways.

Dry Needling Along Kinetic Chains: Evidence and Clinical Applications

Building on the kinetic and fascial chain concepts, clinicians have applied DN not only at symptomatic areas but also along relevant chains to optimize treatment outcomes ^[2,3,6]. A randomized trial found that combining dry needling with pain neuroscience education produced greater improvements in neck pain and disability than DN alone ^[12]. Additionally, a recent trial demonstrated that adding distal DN (targeting gastrocnemius and hamstrings) to local cervical DN significantly improved cervical range of motion and pain intensity compared to cervical DN alone ^[14].

These findings support the clinical relevance of chain-based needling strategies to manage chronic musculoskeletal pain more effectively. While systematic reviews confirm dry needling's efficacy for local myofascial trigger points, newer clinical trials suggest that addressing kinetic chain dysfunctions may yield even better results ^[15]. Thus, dry needling integrated with kinetic chain assessment and treatment represents a promising emerging approach in musculoskeletal rehabilitation.

Analogous Evidence from Related Therapies

Several other therapies mirror the chain-based treatment approach. Foam rolling or self-myofascial release at distal sites (e.g., calves) has been shown to improve flexibility and mobility proximally (e.g., hamstrings, lumbar spine) ^[14]. Acupuncture traditionally targets distal points along meridians, with evidence showing modulation of distant musculoskeletal and visceral dysfunctions ^[10]. Manual therapy techniques addressing fascial lines (e.g., fascial release along the superficial front line) have shown to alleviate pain and postural dysfunctions far from the treatment area ^[2,3,14]. These parallels reinforce the plausibility of using distal dry needling points along kinetic and fascial chains to achieve systemic therapeutic effects.

Clinical Implications and Future Directions

Integrating dry needling into a kinetic-chain approach broadens the clinical view from purely localized trigger point therapy to systemic musculoskeletal management ^[5,8,14]. Clinicians should assess kinetic chain imbalances, myofascial restrictions, and related postural dysfunctions during evaluation.

Future research must address gaps such as standardizing which chains to target, optimal dosing of distal vs local needling, and the long-term outcomes of chain-based dry needling ^[14]. Ultimately, viewing dry needling within a kinetic and fascial chain model may contribute to more comprehensive, effective, and sustainable outcomes for chronic musculoskeletal pain patients.

Conclusion

The kinetic chain and fascial meridian models emphasize the interconnectedness of the human body in health and dysfunction. Dry needling, traditionally considered a local intervention, shows potential for remote and systemic effects through both neural and fascial pathways. Chain-based dry needling, combined with clinical reasoning, offers a promising avenue for managing complex chronic pain presentations. However, larger and more robust clinical trials are needed to substantiate these preliminary observations and to define optimized chain-based protocols. Incorporating kinetic chain thinking into dry needling practice aligns with modern rehabilitation's shift toward holistic, patient-centered care.

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