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# Dry needling as a therapeutic approach for reducing pain in musculoskeletal disorders: a literature review

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**ABSTRACT**

**Background**: Dry needling (DN) has gained popularity as a treatment modality for MSDs, but its effectiveness warrants ongoing assessment. This literature review aimed to evaluate the efficacy of DN in managing MSDs.
**Methods**: The study employed a literature review design and analyzed secondary data from previously published sources. An online literature search was conducted on PubMed using the keywords "dry needling," "musculoskeletal disorders," and "musculoskeletal." Articles were selected based on predefined inclusion criteria, focusing on publications within the last ten years (January 2014 – July 2024).
**Results**: The reviewed studies provide strong evidence supporting the efficacy of dry needling (DN) in managing pain and improving functional outcomes across various musculoskeletal disorders. DN resulted in significant reductions in pain intensity, enhanced range of motion, and improved functional performance in conditions such as fibromyalgia, chronic neck pain, low back pain, and post-ACL reconstruction rehabilitation. While DN led to improvements in autonomic function in fibromyalgia, no significant effects were observed on SpO2 levels. Moreover, DN generally outperformed sham and alternative interventions, reinforcing its value as a therapeutic approach in musculoskeletal rehabilitation.
**Conclusion**: These insights underscore the importance of incorporating DN into treatment plans while considering the need for further research to confirm its benefits.

**Keywords**: dry needling, musculoskeletal disorders, musculoskeletal pain, pain reduction, physical therapy

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## Introduction

Musculoskeletal disorders (MSDs) are a significant occupational health concern, affecting individuals of all ages and genders globally across various sectors. The World Health Organization (WHO) recognizes MSDs as a leading cause of disability, significantly impacting daily life and work performance.1,2 MSDs encompass conditions affecting bones, joints, muscles, and connective tissues, often resulting in pain and reduced function. Chronic pain and functional limitations are primary contributors to disability and unemployment associated with MSDs.[3]

Musculoskeletal disorders (MSDs) can result from a combination of physical and ergonomic risk factors, such as heavy biomechanical loads, repetitive motions, and prolonged static postures. Individual factors, including gender, obesity, and psychological elements like workplace stress, high job demands, limited social support, job strain, and dissatisfaction, also play a role in MSD development. Additionally, social and occupational influences, such as workplace layout, prolonged standing, body twisting, working posture, repetitive actions, task-related force, and vibration exposure, are significant contributors to MSDs.[4]

MSDs are classified into specific and non-specific types. Specific MSDs are characterized by clinically identifiable symptoms, while non-specific MSDs involve pain without clear evidence of a distinct abnormality.[2] Workers in various occupations face health burdens from severe musculoskeletal pain and work-related injuries, collectively known as work-related musculoskeletal disorders (WMSDs), which affect muscles, tendons, and nerves. The increasing prevalence of these disorders among at-risk workers, particularly physicians, has been described as "an impending epidemic" and "the tip of an iceberg," emphasizing the need for greater awareness and preventive measures.

Cross-sectional studies show that over 80% of at-risk physicians experience severe pain during procedures. The prevalence of tendinitis and carpal tunnel syndrome is also

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notably high, though reported rates vary across studies.[5] MSDs are common among healthcare professionals, with prevalence rates exceeding 80% in physiotherapists, massage therapists, nurses, midwives, dentists, and surgeons. This high prevalence is linked to the physical demands and varied tasks inherent in their practices, with many studies highlighting the frequent use of static postures, particularly among surgeons and physiotherapists.[6]

The prevalence of WMSDs is 63.9% among physiotherapists, with the lower back, shoulder, and neck being the most affected areas. Among physiotherapy students, the prevalence is 46.5%, with the lower back, neck, and upper back being the most commonly reported locations.[7] Other studies show that 58.9% of dentists experience musculoskeletal pain, and 74% of laparoscopic surgeons report physical complaints. However, low response rates and high variability across studies create uncertainties, with actual prevalence likely ranging between 22% and 74%.[8,9]

A study found that Asian nurse populations have a high annual incidence rate of MSDs in at least one body part, ranging from 40% to 95%. The lower back, neck, and shoulders are most affected in Western populations, with incidence rates of 29% to 64% for the lower back, 34% to 63% for the neck, and 17% to 75% for the shoulders. In contrast, a narrative literature review on MSDs among female nurses highlights the knee and ankle/foot regions as the most commonly affected. Prevalence rates for MSDs in the ankle range from 3.2% to 100%, while in the knee, it ranges from 7.5% to 77%. The thigh/hip region shows a prevalence range of 11% to 100%, while the lower leg (shin) has a lower prevalence, between 8.5% and 10.5%.[2]

To prevent MSDs, it is important to identify risk factors reported by workers or observed in the workplace, which can then be measured using appropriate instruments. Once these risk factors are identified, prevention strategies focus on monitoring disorder incidence and exposure to high-risk factors. Practical approaches include improving overall workplace health, as studies show that individual risk factors like smoking, being overweight, and poor physical fitness are linked to MSDs. Collaboration with experts from fields such as engineering and psychology is also essential to address MSDs holistically, involving all employees and representatives.

Identifying individual risk factors is essential for providing effective training, administrative controls, and raising awareness of factors such as age, gender, smoking habits, physical activity, and a history of MSDs. Other risk factors include non-occupational activities like sports and household chores, as well as diseases such as rheumatoid arthritis or diabetes. Promoting a healthy lifestyle through regular exercise, good posture, and proper technique in repetitive movements is crucial. Maintaining overall well-being, including mental health, can prevent issues such as physical limitations, social withdrawal, acute and chronic pain, and burdens on other health domains.[10] Studies show that pharmacological options for MSDs are often ineffective and have side effects that complicate long-term use, emphasizing the need for a multidimensional approach involving patient education, behavioral therapy, exercise, and pain management.[9]

DN is a promising addition to a multidimensional approach for long-term pain and disability reduction, particularly in musculoskeletal conditions.[11] DN involves inserting a thin needle through the skin, subcutaneous tissue, and muscle, inducing local muscle contractions to help relax the treated area. This technique can reduce muscle tension and alleviate pain in the affected area.[12] DN can be classified into various types, such as superficial or deep, based on the depth of needle insertion, and trigger point dry needling, fascial needling, and other forms, depending on the tissue targeted.[13]

Several theories explain the mechanisms underlying the effects of DN. First, DN is believed to enhance blood flow to the targeted area, such as the Achilles tendon, promoting tissue healing by improving blood supply. DN is also thought to reduce the formation of taut bands in the tissue, aiding in the recovery of sarcomere and endomysium length, which helps restore tissue elasticity as tension decreases.[13] Additionally, DN may reduce spontaneous electrical activity in sensory nerves around the trigger point, restoring normal function at the neuromuscular junction. Beyond mechanical impacts, DN can induce biochemical changes by suppressing high concentrations of H+ ions, neurotransmitters, cytokines, and chemokines involved in inflammatory and pain responses. Lastly, the needle puncture action may activate the pain gate mechanism, reducing pain perception and enhancing the body's response to painful stimuli. These interrelated mechanisms allow DN to reduce pain and improve healing in patients with various musculoskeletal conditions.[13]

An increasing number of physiotherapists in the United States and globally are adopting DN to treat musculoskeletal pain. As DN gains popularity, it is crucial to continually review the existing evidence to assess its effectiveness.[14] Two credible systematic studies, including meta-analyses, suggest that the efficacy of DN in routine practice is often underappreciated and inadequate when evaluated using the evidence-based medicine approach.[15] While DN has shown promise in pain management, uncertainties remain regarding its overall effectiveness. Although some studies indicate its potential in reducing musculoskeletal pain, more consistent and robust evidence is needed to confirm these findings. The lack of conclusive evidence on DN's effectiveness continues to be a significant concern.[16,17]

MSDs are a significant and widespread global health issue, affecting workers across various sectors and leading to chronic pain and functional loss that impact daily life and work performance. The high prevalence of MSDs among healthcare professionals underscores the urgency of addressing this condition. While the use of DN to manage musculoskeletal pain has increased, its effectiveness remains debated in the medical literature. Therefore, a comprehensive literature review is necessary to clarify

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existing evidence, evaluate the effectiveness of different interventions, and identify optimal prevention and treatment strategies. This study focuses on assessing the effectiveness of DN in MSD cases, particularly its role in pain relief.

## Methods

The research approach employed in this study is a literature review, utilizing secondary data from research journals that analyze dry needling (DN) in patients with musculoskeletal disorders (MSDs). A search was conducted on the PubMed database using keywords such as "dry needling," "musculoskeletal disorders," and "musculoskeletal." From the 20 journals retrieved, seven relevant ones were selected based on category grouping, which included study design, research subjects, interventions, outcomes, and publication year (Figure 1). Inclusion criteria for this review were randomized controlled trials (RCTs) involving subjects with work-related or non-work-related MSDs, studies using DN as the primary intervention, reporting relevant quantitative outcome data, and publications within the last ten years (January 2014 – July 2024). Exclusion criteria included non-RCT studies (e.g., observational studies, case reports, or literature reviews), studies on conditions other than MSDs, studies where DN was not the primary treatment, lack of quantitative data, and publications without full access to research data. Abstracts were analyzed, and irrelevant studies were excluded. Full-text reading and reference scanning were performed before the final literature review analysis.

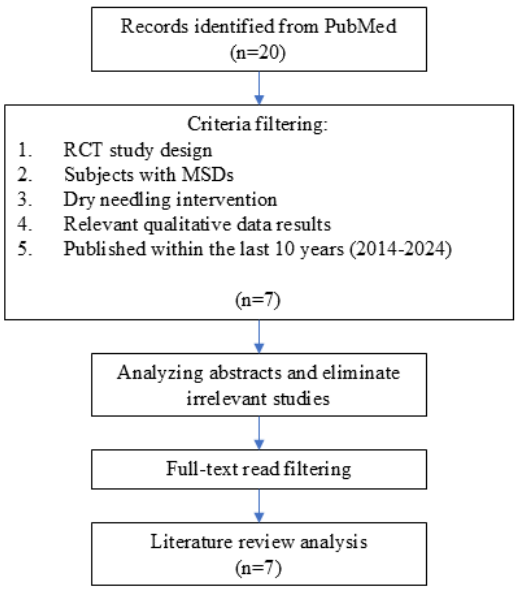


Figure 1. Flowchart of the article screening process

## Results

The study by Castro-Sánchez et al., titled "Benefits of Dry Needling of Myofascial Trigger Points on Autonomic Function and Photoelectric Plethysmography in Patients with Fibromyalgia Syndrome" (2020), involved 74 participants aged 18–68 years diagnosed with fibromyalgia syndrome (FMS), all of whom had experienced pain for at least three days within the 30 days preceding the intervention. Participants were divided into two groups: Group 1 received dry needling (DN), while Group 2 received transcutaneous electrical nerve stimulation (TENS). Pain levels were assessed using the Short-Form McGill Pain Questionnaire (SF-MPQ) and the Visual Analog Scale (VAS). Autonomic parameters, such as oxygen saturation (SpO2), photoplethysmography, heart rate, and galvanic skin reaction, were monitored using the Electro Sensor Complex v.2.5. Results showed significant differences between the groups in VAS scores (p=0.001), heart rate variability in the very low-frequency (p=0.008) and low-frequency (p=0.033) bands, and pain dimensions (sensory, emotional, and overall). However, there were no significant differences between the DN and TENS groups regarding SpO2 levels and spectral photoplethysmography analysis.[18]

The second study, "Efficacy of Dry Needling as an Adjunct to Manual Therapy for Patients with Chronic Mechanical Neck Pain" by Gallego-Sendarrubias et al. (2020), included 101 participants aged 18 to 55 with chronic mechanical neck pain. Participants were divided into two groups: Group 1 received manual treatment and dry needling (DN), while Group 2 received manual therapy and sham DN. Pain levels were assessed using the Numerical Pain Rating Scale (NPRS), the pressure pain threshold (PPT) was measured with a digital algometer, and the cervical range of motion (ROM) was assessed using a universal goniometer. Results showed a significant reduction in pain, with the NPRS dropping by 4.89±0.27 points after four weeks. The intervention group also demonstrated statistically significant improvements in ROM, the neck disability index (NDI) ($p$<0.001), and PPT ($p$<0.001) compared to the control group.[19]

In the study "Immediate Effects of Dry Needling and Myofascial Release on Local and Widespread Pressure Pain Threshold in Individuals with Active Upper Trapezius Trigger Points" by Stieven et al. (2021), 44 participants aged 18 to 50 with myofascial trigger points (MTrPs) and chronic neck pain were divided into three groups: dry needling (DN), sham DN, and myofascial release. Neck pain was measured using the numerical pain rating scale (NPRS), and pressure pain threshold (PPT) was assessed with a digital algometer. Results showed a significant time effect on both the contralateral side (F=4.70, $p$=0.015) and the treated side (F=4.917, $p$=0.001). PPT increased significantly on both the ipsilateral and contralateral sides in both the DN and myofascial release groups. Additionally, neck discomfort decreased significantly following DN ($p$<0.001), myofascial release ($p$<0.001), and sham DN ($p$=0.008).[20]

In the randomized trial "Dry Needling in an Active or Latent Trigger Point in Patients with Neck Pain" by Martín-Sacristán et al. (2022), 65 participants aged 18–65 years with non-specific neck pain lasting at least three months were divided into three groups: DN on active myofascial trigger points (MTrP), latent MTrP, and non-MTrP. Pain intensity was

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assessed using NDI, and the pressure pain threshold was measured with a digital algometer. Results showed a similar reduction in pain intensity across all treated points. However, the group receiving DN at active MTrPs experienced the most significant pain reduction after one week.[21]

The study "The Effectiveness of Dry Needling in Patients with Chronic Low Back Pain" by Rajfur et al. (2022) involved 40 participants aged 36–76 years with chronic low back pain resulting from L5-S1 discopathy. The participants were divided into two groups: Group 1 received DN based on the five regulatory systems (FRS) model, while Group 2 received sham DN. Pain levels were measured using the Visual Analog Scale (VAS), range of motion (ROM) was assessed with the Schober Test, and functional disability was measured using the oswestry disability index (ODI). Results showed significant improvements in all assessments for the DN group compared to the control group ($p$<0.001).[15]

In the study "Effect of Dry Needling on Lumbar Muscle Stiffness in Patients with Low Back Pain" by Koppenhaver et al. (2022), 60 participants aged 18–65 years with low back pain and minimal physical disability (ODI ≥10%) were divided into dry needling (DN) and sham DN groups. Muscle stiffness was assessed using shear wave elastography (SWE), while pain and disability were measured using NPRS and the ODI, respectively. The results showed a significant reduction in lumbar muscle stiffness in the DN group one week post-treatment (p=0.019). Both groups reported significant improvements in pain and disability.[22]

The study "Efficacy of Quadriceps Vastus Medialis Dry Needling in a Rehabilitation Protocol After Surgical Reconstruction of Complete Anterior Cruciate Ligament Rupture" by Velázquez-Saornil et al. (2017) included 44 participants aged 18–55 years recovering from ACL reconstruction. The intervention group followed a rehabilitation protocol combined with DN, while the control group underwent rehabilitation alone. Pain levels were assessed using the VAS, ROM was measured with a universal goniometer, stability was evaluated using the star excursion balance test (SEBT), and the Western Ontario and mcmaster university osteoarthritis index (WOMAC) was used to assess functional outcomes. The results showed significantly greater improvements in the DN group across all measures (VAS, WOMAC, ROM, SEBT) ($p$<0.001).[23]

## Discussion

The results from various studies indicate that dry needling (DN) is an effective intervention for reducing pain in several musculoskeletal conditions, including fibromyalgia syndrome (FMS), chronic mechanical neck pain, and chronic low back pain. In the study conducted by Castro-Sánchez et al. (2020), DN significantly reduced pain compared to transcutaneous electrical nerve stimulation (TENS) therapy in patients with FMS. Similarly, in the study by Gallego-Sendarrubias et al. (2020), DN as part of manual therapy led to a significant reduction in pain after a 4-week intervention in patients with chronic mechanical neck pain.[18,19]

In the study by Stieven et al. (2021)[20], DN significantly reduced neck pain in individuals with active trigger points in the upper trapezius, demonstrating its effectiveness in addressing acute pain at trigger points. Additionally, DN has been shown to increase pressure pain tolerance at trigger points, as evidenced by improvements in Pressure Pain Threshold (PPT) in studies by Gallego-Sendarrubias et al. (2020)19, Koppenhaver et al. (2022)[22], and Martín-Sacristán et al. (2022).[21]

Additionally, dry needling (DN) has a positive impact on range of motion (ROM) and functionality in patients with chronic low back pain and post-anterior cruciate ligament (ACL) reconstruction, as demonstrated in studies by Gallego-Sendarrubias et al. (2020)[19] and Velázquez-Saornil et al. (2017).[23] Overall, the findings from these studies suggest that DN is a promising therapy for managing musculoskeletal pain, with the potential to enhance patients' quality of life through pain reduction and improved bodily functionality.

Although the study results suggest the potential effectiveness of DN in reducing musculoskeletal pain, further research is needed to validate these findings and address limitations in existing studies. Variations in DN techniques and patient characteristics, such as pain location and severity, must be considered when designing interventions. The generalizability of the results also depends on the clinical setting and patient population, highlighting the need to evaluate existing research before determining if DN is appropriate for a specific clinical context. These findings provide valuable insights for clinical practice, demonstrating DN's effectiveness in reducing pain and improving function in conditions like low back and neck pain. They also emphasize the importance of considering individual patient factors and existing evidence when selecting therapies, ultimately guiding healthcare practitioners in making optimal care decisions for patients.

## Conclusions

This literature review suggests that DN may be an effective short-term therapy for reducing musculoskeletal pain. Several studies indicate that DN could outperform no intervention or placebo in reducing pain intensity and improving physical function and quality of life. However, the quality of outcomes varies across studies, and some research presents methodological limitations that need addressing. While these findings support DN as a promising adjunctive therapy, further research with more robust designs and larger sample sizes is necessary to validate its effectiveness for various musculoskeletal conditions. Clinical practitioners should consider the existing evidence before incorporating DN into their practice, while remaining open to ongoing research to better understand its role in managing musculoskeletal pain

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This study does not have any conflicts of interest to disclose.

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**Conflict of interest**

No external funding was received to conduct this study.

**Author contributions**

IGBNGAS performed the literature review, and drafted and revised the manuscript, while AAGAPN developed the research framework, contributed to the literature review, and critically reviewed the manuscript

**Ethical consideration**

This review study was based solely on publicly accessible published articles and, as such, did not necessitate informed consent or ethical approval..

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