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Comparative Effectivenesss of Dry Needling and Deep Friction Massage in Myofascial Pain Syndrome: an Original Research

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ABSTRACT

INTRODUCTION. Myofascial Pain Syndrome (MPS) is a common condition that limits mobility and causes chronic pain. While myofascial trigger points are recognized as key contributors, the most effective treatments remain debated. Dry Needling (DN) and Deep Friction Massage (DFM) are commonly used, but direct comparisons of their effectiveness in pain reduction, range of motion (ROM) improvement, and trigger point size changes are scarce. Research often assesses these treatments separately, leaving a gap in understanding their comparative efficacy.

AIM. To evaluate the comparative effectiveness of DN and DFM on MPS.

MATERIALS AND METHODS. Thirty-six participants were divided into DN and DFM groups. Evaluations were conducted before and 30 minutes after treatment, assessing pain levels with Visual Analogue Scale (VAS), Range of Motion (ROM) with a goniometer, and trigger point size using ultrasonography.

RESULTS AND DISCUSSION. Both groups exhibited significant reductions in pain levels ($p < 0.05$). The DFM group demonstrated more substantial delta change in pain reduction (31.81 ± 7.6) compared to the DN group (18.19 ± 8.8). Both groups showed significant improvements in ROM ($p < 0.05$), with DFM having a greater impact on flexion, extension, and lateral flexion. No significant difference was observed in rotational movements between the two groups. Regarding trigger point size, only the DFM group showed significant changes ($p < 0.05$); however, the delta change between DN (0.38 ± 0.5) and DFM (0.35 ± 0.3) were not statistically significant ($p > 0.05$).

CONCLUSION. Both DN and DFM effectively reduce pain and increase ROM, although neither of them significantly changed trigger point size. DFM provided better results in pain reduction 30 minutes post-treatment compared to DN.

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KEYWORDS: dry needling, deep friction massage, neck pain, myofascial pain syndrome, trigger point

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Сравнительная эффективность сухого иглоукалывания и глубокого фрикционного массажа при миофасциальном болевом синдроме: оригинальное исследование

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РЕЗЮМЕ

ВВЕДЕНИЕ. Миофасциальный болевой синдром (МБС) — это распространенное заболевание, которое ограничивает подвижность и вызывает хроническую боль. Хотя миофасциальные триггерные точки признаны ключевыми факторами, наиболее эффективные методы лечения остаются спорными. Широко используются сухое иглоукалывание (СИ) и глубокий фрикционный массаж (ГФМ), но прямых сравнений их эффективности в отношении уменьшения боли, улучшения диапазона движения (ДД) и изменения размеров триггерных точек мало. Исследования часто оценивают эти процедуры по отдельности, что оставляет пробел в понимании их сравнительной эффективности.

ЦЕЛЬ. Оценить сравнительную эффективность СИ и ГФМ в отношении МБС.

МАТЕРИАЛЫ И МЕТОДЫ. Тридцать шесть участников были разделены на группы СИ и ГФМ. Оценки проводились до процедуры и через 30 минут после нее, при этом оценивался уровень боли по визуальной аналоговой шкале, ДД — с помощью гониометра, размер триггерных точек — с помощью ультрасонографии.

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ. В обеих группах наблюдалось значительное снижение уровня боли ($p < 0,05$). Группа ГФМ продемонстрировала более значительное дельта-изменение в уменьшении боли (31,81 ± 7,6) по сравнению с группой СИ (18,19 ± 8,8). Обе группы продемонстрировали значительное улучшение ДД ($p < 0,05$), причем ГФМ оказала большее влияние на сгибание, разгибание и боковое сгибание. Во вращательных движениях между двумя группами существенных различий не наблюдалось. Что касается размера триггерных точек, то только в группе ГФМ наблюдались значительные изменения ($p < 0,05$); однако дельта изменений между СИ (0,38 ± 0,5) и ГФМ (0,35 ± 0,3) не была статистически значимой ($p > 0,05$).

ЗАКЛЮЧЕНИЕ. Как СИ, так и ГФМ эффективно уменьшают боль и увеличивают ДД, хотя ни один из них существенно не изменил размер триггерных точек. ГФМ обеспечил лучшие результаты по уменьшению боли через 30 минут после процедуры по сравнению с СИ.

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КЛЮЧЕВЫЕ СЛОВА: сухое иглоукалывание, массаж глубокого трения, боль в шее, миофасциальный болевой синдром, триггерные точки

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INTRODUCTION

Myofascial Pain Syndrome (MPS) is a musculoskeletal disorder that results in stiffness, fatigue, tenderness, muscle tension, and restricted range of motion in affected joints [1]. It is characterized by hyperirritable nodules within skeletal muscle fibers, known as MTrPs [2]. Contributing factors to MPS include the failure of the myoprotective feedback mechanism due to excessive muscle activity, reduced ATP levels, or decreased muscle pH [3]. MTrPs can also impair postural stability, as evidenced by reduced balance function in individuals with multiple trigger points. Frequently affected muscles include the trapezius, rhomboid, infraspinatus, levator scapulae, and paravertebral muscles [4]. MPS diagnosis typically involves clinical examination and palpation of MTrPs, with ultrasonography (USG) emerging as a more precise diagnostic tool [5]. USG also aids in evaluating treatment outcomes for MPS [6].

Physiotherapists commonly use therapeutic interventions such as ischemic compression, kinesiotaping, myofascial release, deep friction massage (DFM), and dry needling (DN) to alleviate MPS symptoms. These therapies effectively reduce pain and improve muscle function in patients with MTrPs [7, 8]. Systematic reviews highlight DN's efficacy in reducing pain intensity and improving cervical range of motion (ROM) in patients with neck pain-related MTrPs [9]. Numerous studies support DN's effectiveness in pain reduction, attributing its success to its ability to modulate pain perception and disrupt pain signaling pathways, leading to ROM and muscle strength improvements [10]. DN is a minimally invasive, cost-effective technique with a low risk of complications when performed by trained practitioners [11].

DFM is another widely used intervention. Research indicates that DFM applied to the upper trapezius muscle effectively reduces pain and enhances ROM in MPS patients [12]. These findings are consistent with studies reporting significant ROM improvements following DFM in patients with upper trapezius trigger points [13]. DFM's immediate benefits include stimulating local blood flow and reducing muscle tension, thereby improving ROM [14]. DFM's effectiveness is further supported by understanding the complex pathophysiological mechanisms underlying MPS, where trigger points can be alleviated through manual therapy techniques like DFM [1].

Several studies have compared the effectiveness of DFM and Kamali D.N. et al. 2019 and Stieven et al. 2021 found similar results, showing that DN led to a greater increase in pain thresholds [15, 16]. In contrast, other studies reported better pressure pain threshold improvements MTrPs using conventional physiotherapy methods like DFM. Despite this, DN is often favored for its ability to shorten therapy session durations [17].

Despite robust scientific evidence supporting both DFM and DN, direct comparative studies assessing their relative effectiveness are lacking. This study aims to evaluate DFM and DN's efficacy through subjective pain assessment using the Visual Analogue Scale (VAS) and objective range of motion measurement using a goniometer. Ultrasonography will also be employed to diagnose and assess trigger point size objectively. The goal is to provide evidence-based insights into the most effective treatment options for managing MPS.

MATERIALS AND METHODS

Participants

This study used a quasi-experimental design with a pretest-posttest setup involving two groups. The participants were divided as follows: the DN group (n = 16) received dry needling treatment, and the DFM group (n = 16) received deep friction massage. The clinical characteristics of all 32 participants are detailed in Table 1.

Participants in this study were aged 20 to 55 years and experienced neck pain for up to three months. Physical examinations revealed at least one palpable nodule in the trapezius, rhomboid, or supraspinatus muscle, with MTrPs confirmed by ultrasonography. Exclusion criteria included a history of chronic diseases like diabetes or cancer, the use of Nonsteroidal Anti-Inflammatory Drugs or analgesics, skin infections, open wounds, or undergoing other therapeutic treatments outside the study.

Table 1. Clinical characteristics of the 32 participants

Characteristic	DN	DFM	Min	Max
Total Participant (N)	16	16	—	—
Gender (M/F)	11/5	6/10	—	—
Age (Years Old)	39 ± 8.20	29 ± 5.47	26	52

Note: *M — Male; F — Female; DN — Dry Needling; DFM — Deep Friction Massage. Data are presented as Mean ± SD where applicable.*

Ethical procedure

Informed consent was obtained from the participants, and the study received approval from the Ethics Committee.

Measurement

Pre-test measurements were conducted 5 minutes before treatment and post-test 30 minutes after treatment. All physical examinations and treatments were performed by experienced physiotherapists, who have experience in evaluating and treating myofascial pain syndrome. The initial test and final test were identical. Participants will receive an explanation of the test procedure before treatment.

Pain levels

VAS measures pain using a 10 cm (or 100 mm) line, ranging from "no pain" to "worst pain." Participants mark a point on the line representing their pain level. The distance from the starting point to their mark, measured in millimeters, is recorded as the score.

Range of motions

Cervical ROM was assessed with patients seated and their heads in a neutral position. A goniometer was used, with its axis aligned to anatomical landmarks: the C7 spinous process for lateral flexion, the external auditory meatus for flexion-extension, and the midpoint of the head for rotation. The angles were recorded in degrees.

Trigger point size

MTrPs were identified as hypoechoic nodules with distinct edges and heterogeneous internal texture, as seen on ultrasonography. The Versanna Essential Ultrasound System (serial number 6023709WX0) was used. Measurements of TP size were taken using the system's integrated measurement tools.

Procedure

Participants were comfortably positioned for the treatments. For the DN group, USG at 8–10 Hz was used to precisely locate MTrPs and guide needle insertion. After cleaning the target area with alcohol, a sterile needle was inserted into the MTrP and manipulated with back-and-forth and rotational movements for 60 seconds.

In the DFM group, ultrasound was used to locate the trigger point, which was then marked with a pen. Using an elbow, a cross-fiber friction technique was applied with consistent pressure to the marked area for 60 seconds. The pressure was adjusted to the patient's pain tolerance, and the process was repeated three times per session.

Statistical analysis

IBM SPSS Statistics for Windows, version 25.0, was used to analyze all data. All data were tested for normality using the Shapiro-Wilk test. For normally distributed data, in this study, pain level and range of motion, paired t-test was used. Independent t-test was used to test differences between groups. For non-normally distributed data, in this study, MTrP size was used using the Wilcoxon nonparametric test to compare pre-test and post-test. Mann-Whitney test was used to compare differences between groups. Mean ± standard deviation was used to display data. If p value is less than 0.05, the difference is considered statistically significant.

RESULTS AND DISCUSSION

Baseline data

Thirty-two participants were included in this study. They were divided into two groups, DN group (11 males and 5 females) with a mean age of 39.81 ± 8.207 and DFM group (6 males and 10 females) with a mean age of 29.31 ± 5.474. All participants had myofascial trigger points as evidenced by ultrasonography. In all participants, only the most symptomatic trigger points were treated. All participants completed the program and no participants dropped out.

Data description

Comparison of pre and post tests and analysis of differences in pain levels in the Dry Needling and Deep Friction Massage groups

The DN group showed a mean pre-test score of 65.3 ± 1.2, which dropped to 47.1 ± 2.5 after treatment, indicating a significant reduction in pain levels ($p < 0.05$). Similarly, the DFM group had a mean pre-test score of 67.2 ± 1.2, which decreased to 35.4 ± 2.5 post-treatment. Statistical analysis confirmed a significant improvement in pain levels (p < 0.05) for both groups. These results suggest that both DN and DFM are effective in reducing pain.

Comparing the DN and DFM groups to find out which is better in reducing pain. The mean Δ (delta) change in pain levels in the DN group was 18.1 ± 8.8 while in the DFM group it was 31.8 ± 7.6 (Fig. 1). The results indicate significant changes in both groups ($p < 0.05$). However, the greatest positive changes occurred in the DFM group so that DFM was better for changes in pain levels.

Comparison of pre and post tests and analysis of differences in range of motion in The Dry Needling and Deep Friction Massage groups

In the DN group, cervical ROM improved significantly across all movements. The mean pre-test flexion was 35.13 ± 3.7, increasing to 51.31 ± 3.3 post-test. Extension improved from 44.88 ± 3.3 to 51.31 ± 3.3, lateral flexion from 33.56 ± 1.9 to 41.00 ± 2.3, and rotation from 48.75 ± 0.9 to 62.69 ± 1.2. Statistical analysis confirmed these improvements as significant ($p < 0.05$), demonstrating DN's effectiveness in enhancing cervical ROM.

Similarly, the DFM group also showed significant ROM improvements in all movements. The mean pre-test flexion increased from 46.25 ± 1.0 to 55.56 ± 0.9 post-test. Extension rose from 45.00 ± 3.8 to 51.18 ± 4.0, lateral flexion from 32.00 ± 0.7 to 40.75 ± 0.4, and rotation from 48.06 ± 1.2 to 61.56 ± 1.2. These results indicate that DFM effectively enhances ROM in MPS cases ($p < 0.05$).

The Δ (delta) changes in cervical movements showed similar improvements in both the DN and DFM groups. For flexion, the DN group had a mean Δ change of 6.94 ± 4.2, while the DFM group recorded 9.25 ± 3.3. In extension, the mean Δ change was 6.44 ± 2.1 for the DN group and 7.81 ± 2.9 for the DFM group. Lateral flexion showed a mean Δ change of 7.44 ± 2.2 for the DN group and 8.75 ± 3.1 for the DFM group. For rotation, the DN group recorded 13.75 ± 3.8, and the DFM group had 13.50 ± 4.0. Statistical analysis revealed no significant differences ($p > 0.05$) in these changes between the two groups. This suggests that both DN and DFM are equally effective in improving cervical ROM in MPS.

Comparison of pre and post tests and analysis of differences in trigger point size in the Dry Needling and Deep Friction Massage groups

In both the DN and DFM groups, an increase in trigger point size was observed. For the DN group, the mean pre-test size was 0.66 ± 0.8, rising to 0.87 ± 0.1 post-test. Statistical analysis showed no significant changes in trigger point size for this group ($p > 0.05$). Within 30 minutes post-treatment, 9 participants in the DN group showed a decrease in trigger point size, while 7 showed an increase (Fig. 2).

Similarly, the DFM group showed an increase in trigger point size, with a mean pre-test size of 1.00 ± 0.15 increasing to 1.30 ± 0.2 post-test. In this group, 4 participants experienced a reduction in size, while 12 showed an increase (Fig. 3). Unlike the DN group, the DFM group displayed significant changes in trigger point size according to statistical analysis ($p < 0.05$).

The mean Δ (delta) change in trigger pont size in the DN group was 0.38±0.5 while in the DFM group it was 0.35 ± 0.3. In the group comparison, 30 minutes after treatment both groups did not show significant delta changes in trigger point size ($p > 0.05$) (Fig. 4).

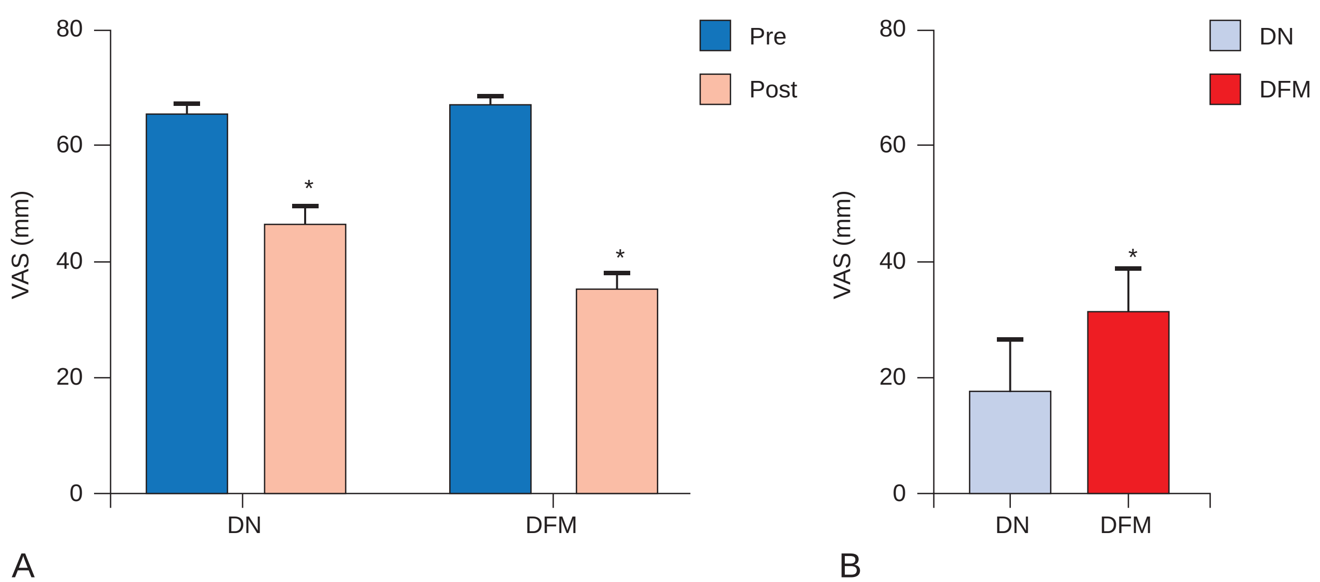

Fig. 1. Changes in pain level in DN and DFM groups

Note: *A — Comparison of pre- and post-tests ROM in the DN group; B — Shows The Δ (delta) change represents the difference between post- and pre-intervention values (Δ = Post-Pre). The asterisk * — p < 0.05 indicates a statically significant result.*

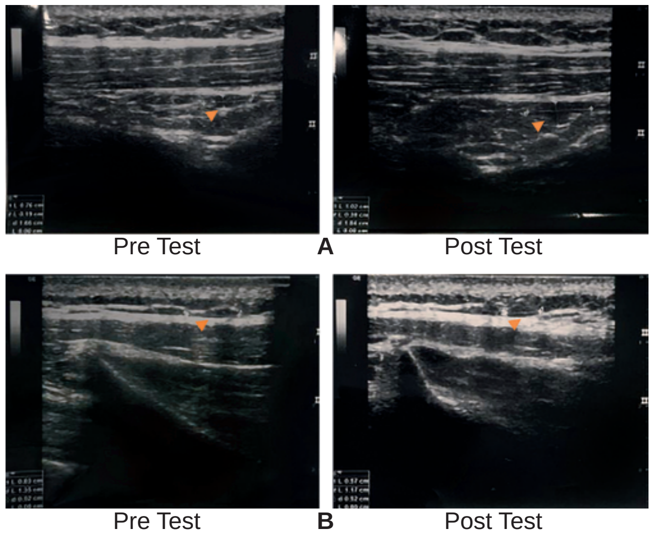

Fig. 2. Ultrasound Images of Neck Muscles Pre- and Post-Dry Needling Showing Changes in Trigger Point Size

Note: *A — presents ultrasonographic (USG) images of the neck muscles captured before and after the dry needling (DN) intervention, showing an increase in trigger point size from 0.45 cm to 1.15 cm; B — displays USG images of the neck muscles obtained pre- and post- DN, highlighting a reduction in trigger point size from 1.01 cm to 0.93 cm.*

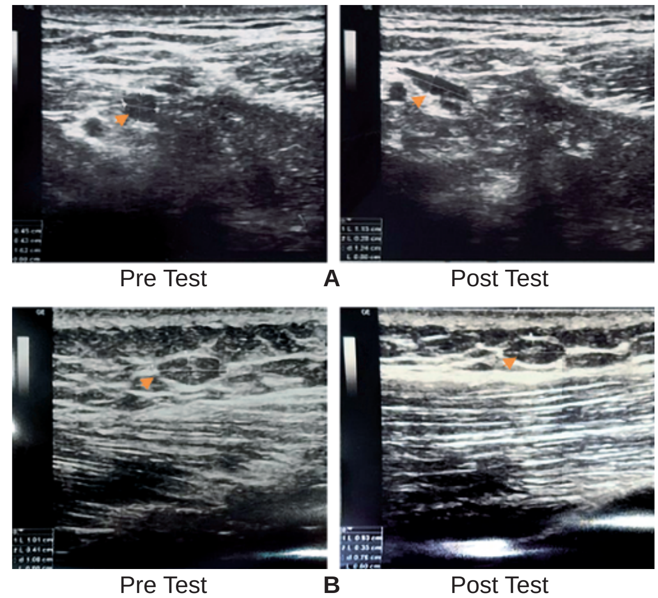

Fig. 3. Ultrasound Images of Neck Muscles Pre and Post Deep Friction Massage Showing Trigger Point Size Changes

Note: *A — presents ultrasonographic (USG) images of the neck muscles captured before and after the deep friction massage (DFM) intervention, showing an increase in trigger point size from 0.76 cm to 1.02 cm; B — displays USG images of the neck muscles obtained pre- and post- DFM, highlighting a reduction in trigger point size from 0.83 cm to 0.57 cm.*

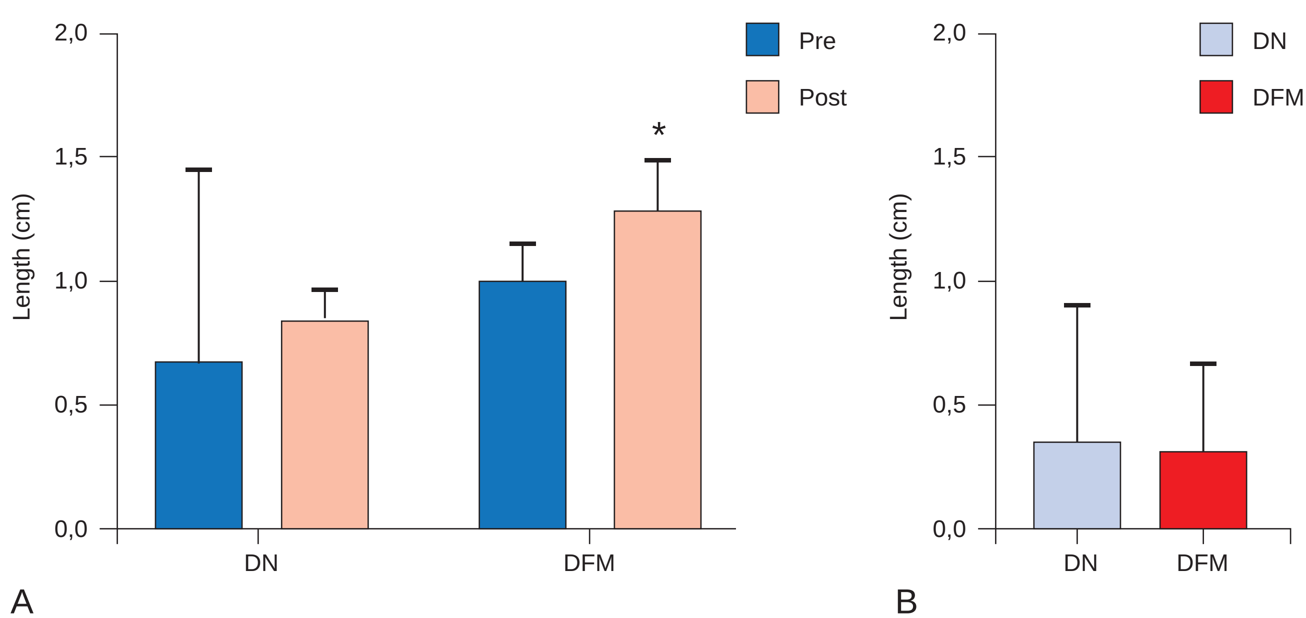

Fig. 4. Changes in trigger point size 30 minutes after dry needling in DN and DFM groups

Note: *A — Comparison of pre- and post-tests of DN and DFM groups; B — The Δ (delta) change represents the difference between post- and pre-intervention values (Δ = Post-Pre). The asterisk * — p > 0.05 indicates a statically significant result.*

Comparison of pre and post tests and analysis of differences in pain levels in the Dry Needling and Deep Friction Massage groups

Pain reduction is a primary goal in MPS management. Our findings demonstrate that both DN and DFM effectively decrease pain intensity. In the DN group, a decrease in pain intensity was observed 30 minutes after treatment. The results we obtained the mean pain level of the DN group decreased from 65.3 ± 1.2 and after treatment decreased to 47.1 ± 2.5.

This finding is consistent with prior research demonstrating that DN significantly reduces pain in MTrPs [18]. MTrPs are characterized by the activation of nociceptors, which respond to noxious stimuli.

Shah J.P. et al. 2008 found that persistent activation of these receptors leads to central sensitization, resulting in heightened sensitivity to pain [19]. This process is marked by increased levels of inflammatory mediators around MTrPs, such as Substance P (SP), Calcitonin Gene-Related Peptide, bradykinin, and pro-inflammatory cytokines like TNF-α and IL-1β. These substances contribute to both the inflammatory response and the amplification of pain sensitivity. Additionally, the biochemical environment surrounding active MTrPs is often associated with local ischemia (reduced blood flow) and hypoxia (oxygen deprivation), which can exacerbate pain and inflammation. The accumulation of protons, resulting in a lower pH, creates an acidic microenvironment that sensitizes nociceptors, thereby enhancing pain perception. DN has been shown to offer pain relief in MTrP through increased blood flow [20]. Furthermore, previous studies indicate that DN enhances blood circulation and metabolism, which promotes muscle relaxation. This effect is thought to be mediated by the release of vasoactive substances, including calcitonin-related peptides and SP. These substances activate A-δ and C fibers via the axon reflex, resulting in vasodilation of small blood vessels and subsequent increases in blood flow [21].

In addition to these effects, DN also directly targets MTrPs, reducing muscle tension and pain while stimulating the release of endorphins and neurotransmitters [22]. A notable study involving a rabbit model found that a single session of DN applied to the biceps femoris, containing active MTrPs, significantly increased beta-endorphin levels in both the biceps femoris and serum, while simultaneously reducing SP levels in the muscle. This finding suggests that even a single session of DN may offer beneficial effects for treating MTrPs [23].

Pain reduction was also observed in the DFM group. DFM group experienced a decrease in pain intensity from 67.2 ± 1.2 to 35.4 ± 2.5, a result that is consistent with previous studies. Zutshi K. et al. 2021 [24] research demonstrated that myofascial release techniques, including DFM, effectively increase pain thresholds and reduce disability in MTrPs of the upper trapezius muscle. Similarly, Bau J.G. et al. 2021 [25] found that DFM enhances microcirculation and alleviates pain in patients with neck and shoulder pain, further supporting its use in managing cervical pain. The deep and targeted pressure applied during DFM induces vasodilation, which improves blood flow to the affected area. This process not only helps clear irritants, such as inflammatory substances, that contribute to pain but also enhances the delivery of oxygen and nutrients to damaged tissues [26]. Studies indicate that this increased blood flow plays a significant role in pain reduction and accelerates the healing process [14]. Furthermore, DFM may modulate pain impulses at the spinal level. By stimulating large nerve fibers through applied pressure, DFM inhibits the transmission of pain signals carried by smaller nerve fibers, aligning with the "gate control" theory of pain modulation [27].

The Δ (delta) change between DFM and DN groups reveals that DFM results in more significant improvements in pain alleviation, particularly with respect to post-treatment discomfort. Several participants reported that the discomfort following DFM was less intense and less disruptive to daily activities compared to the potentially greater pain associated with needle insertion in DN. DFM not only focuses on pain relief but also emphasizes patient comfort and relaxation. Research suggests that massage therapies promote the release of endorphins and oxytocin, which contribute to pain reduction and facilitate relaxation in individuals [28]. These findings highlight the broader therapeutic benefits of DFM, which may enhance overall well-being in addition to addressing pain symptoms.

Comparison of pre and post tests and analysis of differences in range of motion in the Dry Needling and Deep Friction Massage groups

Both DN and DFM led to significant improvements in cervical ROM, highlighting their ability to alleviate muscle tightness and restore functional movement. The efficacy of DN in enhancing ROM is likely attributed to its effects on myofascial tissue relaxation and neuromuscular modulation. By inducing muscle relaxation, DN helps break the pain-spasm-pain cycle, reducing myofascial stiffness and promoting greater mobility.

DN improves cervical ROM through several musculoskeletal and neurological processes. First, DN helps relieve muscle tension and spasms, which are key factors limiting ROM. Studies indicate that stimulating MTrPs with needles boosts blood flow to the area, reducing hypoxia, enhancing tissue oxygenation, and aiding muscle recovery, which together increase ROM [9]. Additionally, DN triggers neuromuscular responses that improve muscle function. It enhances cervical segmental stability and reduces pain, which supports better joint mobility [29]. By activating deep cervical muscles, DN restores balance between the extensor and flexor muscles, essential for proper neck movement control. Finally, DN activates the body's pain inhibition system by stimulating nociceptive and enkephalinergic fibers, reducing pain perception [30]. With pain alleviated, participants can move more freely, thereby improving cervical ROM.

Similarly, DFM applies mechanical pressure that helps remodel collagen, break down adhesions, and restore muscle elasticity. It has been shown to significantly enhance ROM in the cervical joints through various physiological and biomechanical effects. One key mechanism is improved local blood circulation. By targeting muscle fibers, DFM applies pressure that separates them mechanically, increasing local blood flow[26]. This enhanced circulation alleviates pain, clears metabolic waste, and reduces muscle tension. Increased blood flow also decreases inflammation and boosts tissue oxygenation, essential for relieving stiffness and improving cervical joint mobility. Additionally, DFM may help reduce adhesions and scar tissue, promoting flexibility and ROM in the cervical region [14]. The mechanical stimulation from DFM can also trigger a reflexive relaxation of muscles, lowering muscle tone and further improving ROM [31]. Beyond these physical effects, DFM induces a state of relaxation, which supports better muscle function and coordination, contributing to its overall effectiveness in enhancing cervical joint mobility [32].

While both interventions improved ROM across multiple planes of movement, the comparative analysis revealed that DFM had a more pronounced effect on flexion, extension, and lateral flexion, whereas improvements in rotation were comparable between groups (Fig. 5). This suggests that while DN remains a viable option for enhancing mobility, DFM may offer more comprehensive benefits in addressing functional impairments associated with MPS.

Comparison of pre and post tests and analysis of differences in trigger point size in the Dry Needling and Deep Friction Massage groups

This study uniquely employed ultrasonography to objectively measure trigger point (TP) size. Results showed that neither DN nor DFM significantly reduced TP size within 30 minutes post-treatment, indicating that visible structural changes in myofascial tissue may require more time. Interestingly, the DN group exhibited individual variations: some participants experienced a decrease in TP size, while others showed an increase (Table 2). These differences could be linked to the acute inflammatory response caused by needle insertion, a topic deserving further exploration.

Table 2. Changes in the size of trigger points in the DN and DFM groups

Participants Group	Trigger Point Size	
	Decrease	Increase
DN group	9	7
DFM group	4	12

Note: *"Decrease" indicates the participants who showed a reduction in trigger point size after treatment, while "Increase" refers to those who experienced an enlargement in trigger point size post-treatment. DN — Dry Needling; DFM — and Deep Friction Massage.*

The enlargement of MTrPs was observed in participants who had been experiencing pain for less than 5 days. This response is likely part of the healing process, as needle insertion into the trigger point can induce a local inflammatory reaction. This inflammatory response is characterized by increased blood flow and the release of inflammatory mediators, which can lead to localized swelling and pain in the affected area [33]. The body's response involves enhanced blood circulation and the mobilization of immune cells to the site of injury, facilitating tissue repair [34]. Research by Nowak et al. suggests that direct intervention on trigger points may provoke a transient inflammatory reaction, potentially leading to an increase in TP size [35].

In contrast, participants who had experienced pain for more than 5 days demonstrated a reduction in TP size. This may be due to the MTrPs transitioning from the acute phase, in which the nervous system becomes hyper-responsive, altering pain perception and diminishing the ability to elicit a twitch response [36]. However, further research is needed to explore the duration of pain relief following dry needling and to better understand the temporal dynamics of TP size changes in response to treatment.

DFM group, despite demonstrating significant improvements in pain reduction and ROM, exhibited varied responses in trigger point size, with some participants

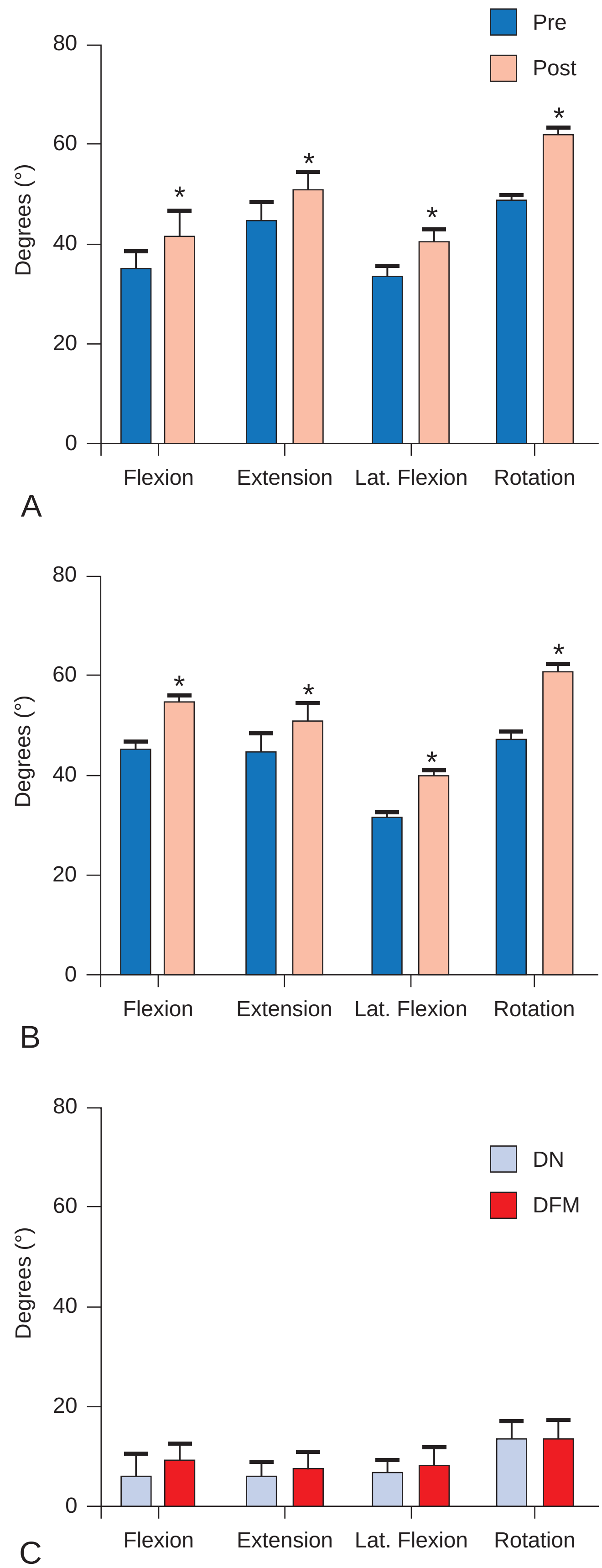

Fig. 5. Changes ROM in flexion, extention, lateral flexion, and rotation 30 minutes after treatment DN and DFM groups

Note: *A — Comparison of pre- and post-tests ROM in the DN group; B — Comparison of pre- and post-tests ROM in the DFM group; C — The Δ (delta) change represents the difference between post- and pre-intervention values (Δ = Post-Pre). The asterisk * — p < 0.05 indicates a statically significant result.*

showing an increase and others a decrease (Table 2). This variability supports the notion that immediate symptom relief does not necessarily correspond to immediate structural changes in MTrPs.

The pre- and post-treatment evaluations for the DFM group showed notable changes in trigger point (TP) size, potentially due to less variability in individual responses. Specifically, 12 participants experienced an increase in TP size, while 4 showed a decrease. The reduction in MTrP size could be linked to DFM's ability to stimulate fibroblast activity, which is essential for tissue healing and remodeling. The mechanical pressure applied during DFM helps realign collagen fibers and improve tissue integrity [26]. Additionally, the transverse friction technique used in DFM targets muscle fibers, promoting a healing process that reduces muscle tension and tightness, leading to a decrease in MTrP size [37]. As muscle tension lessens, joint mobility improves, further contributing to the reduction in MTrP size since tight muscles often restrict joint movement.

In contrast, some participants experienced an increase in TP size after DFM, likely due to the inflammatory response caused by tissue manipulation. The deep pressure applied during DFM can create microtrauma in muscle fibers, triggering localized inflammation as part of the natural healing process [38]. This inflammation may temporarily lead to swelling or heightened sensitivity, which can appear as TP enlargement. However, this effect is usually short-lived, and with ongoing treatment, TPs generally decrease in size, accompanied by symptom improvement [39]. The relationship between pain duration and the body's response to treatment is an area requiring further investigation. Future studies should focus on the factors influencing whether TPs grow or shrink following therapeutic interventions.

DFM may provide greater benefits as its mechanical pressure applied along muscle fibers helps break down adhesions. However, DN also showed effects, despite no significant change in TP size. This difference might be due to the DN group having both acute and chronic conditions, which may have influenced the results. In comparison, the DFM group had more participants with acute conditions. To better understand these treatments, future research should focus on the long-term effects of DFM and DN on TP size and their role in managing MPS.

CONCLUSION

This study provides valuable comparative insights into the effectiveness of DN and DFM in the treatment of MPS. While both interventions significantly reduce pain and enhance ROM, DFM demonstrates superior efficacy in pain relief and broader improvements in movement. The absence of immediate trigger point size reduction suggests that structural changes require more prolonged treatment. These findings emphasize the clinical utility of DFM as an optimal therapeutic choice for acute pain management while reinforcing DN's role in neuromuscular modulation. Future studies should focus on long-term treatment outcomes and individualized therapy protocols to optimize patient care in MPS management.

ADDITIONAL INFORMATION

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