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HOW DOES POST-NEEDLING SORENESS DIFFER BETWEEN THE IN-OUT AND ROLLING DRY NEEDLING TECHNIQUES ?

Bayu Prastowo[1], Nurul Intan Fadhilah[2], Dia Rafidya Tamimi[3], Syi'ar Aprilla Tanazza[4]

[1,2,3]Physiotherapy Department, Faculty of Health Sciences, University of Muhammadiyah Malang, Indonesia
[4]Department of Sports Medicine, College of Medicine, Kaohsiung Medical University, Taiwan
bayuprastowo@umm.ac.id

ABSTRACT

Introduction: Post-Needling Soreness is the most frequently reported transient adverse event following dry needling and may negatively affect patient comfort and treatment adherence. This study aimed to compare the severity of Post-Needling Soreness between the In-Out and Rolling dry needling techniques in individuals with upper trapezius Myofascial Trigger Point Syndrome (MTrPS). **Method**: A quasi-experimental study was conducted involving 92 participants with upper trapezius MTrPS. Post-Needling Soreness was assessed using the Visual Analog Scale (VAS) at 0.5, 24, 48, and 72 hours after the intervention. Differences between groups at each time point were analyzed using the Mann-Whitney U test, while changes over time and interaction effects were examined using mixed ANOVA. **Result:** The Rolling technique produced significantly greater Post-Needling Soreness than the In-Out technique at 0.5 hours post-intervention ($p=0.026$). However, no significant between-group differences were observed at 24, 48, or 72 hours ($p>0.05$). Mixed ANOVA demonstrated significant main effects of dry needling technique ($p=0.029$) and time ($p<0.001$). That interaction between technique and time was not statistically significant ($p=0.456$). **Conclusion:** Both groups exhibited a progressive reduction in Post-Needling Soreness throughout the 72 hour follow-up period. The In-Out technique resulted in lower acute Post-Needling Soreness than the Rolling technique, although both techniques demonstrated a similar recovery profile over 72 hours. These findings suggest that the In-Out technique may be preferable when minimizing immediate post-treatment discomfort is a clinical priority.
Keyword: dry needling, local twitch response, upper trapezius, in-out technique, rolling technique

PERBANDINGAN *POST-NEEDLING SORENESS* ANTARA TEKNIK DRY NEEDLING IN-OUT DAN ROLLING

ABSTRAK

Pendahuluan: *Post-Needling Soreness* merupakan efek samping sementara yang paling sering dilaporkan setelah tindakan *dry needling* dan berpotensi menurunkan kenyamanan pasien serta kepatuhan terhadap terapi. Penelitian ini bertujuan untuk membandingkan tingkat keparahan *Post-Needling Soreness* antara teknik *In-Out* dan *Rolling* pada individu dengan *Myofascial Trigger Point Syndrome* (MTrPS) otot *upper trapezius.* **Metode:** Penelitian ini menggunakan desain kuasi-eksperimental yang melibatkan 92 partisipan dengan MTrPs pada otot upper trapezius. *Post-Needling Soreness* diukur menggunakan *Visual Analog Scale* (VAS) pada 0,5 jam, 24 jam, 48 jam, dan 72 jam setelah intervensi. Perbedaan antar kelompok pada setiap waktu pengukuran dianalisis menggunakan uji Mann-Whitney U, sedangkan perubahan skor dari waktu ke waktu serta efek interaksi antara teknik dan waktu dianalisis menggunakan *mixed* ANOVA. **Hasil:** Teknik *Rolling* menghasilkan tingkat *Post-Needling Soreness* yang secara signifikan lebih tinggi dibandingkan *In-Out* pada 0,5 jam setelah intervensi ($p = 0{,}026$). Namun, tidak terdapat perbedaan yang signifikan antara kedua kelompok pada 24 jam, 48 jam, maupun 72 jam setelah intervensi ($p > 0{,}05$). Hasil analisis *mixed* ANOVA menunjukkan adanya pengaruh utama yang signifikan dari teknik *dry needling* ($p = 0{,}029$) dan waktu pengukuran ($p < 0{,}001$). Sementara itu, interaksi antara teknik *dry needling* dan waktu pengukuran tidak menunjukkan perbedaan yang bermakna secara statistik ($p = 0{,}456$). **Kesimpulan:** Kedua kelompok menunjukkan penurunan *Post-Needling Soreness* secara bertahap selama 72 jam. Teknik *In-Out* menghasilkan *Post-Needling Soreness* akut yang lebih rendah dibandingkan teknik *Rolling*, meskipun kedua teknik menunjukkan pola pemulihan yang serupa selama 72 jam. Temuan ini menunjukkan bahwa teknik *In-Out* dapat menjadi pilihan yang lebih tepat apabila tujuan klinis utama adalah meminimalkan ketidaknyamanan setelah *dry needling.*
Kata Kunci: dry needling, respons kedutan lokal; otot trapezius, teknik *in-out*, teknik *rolling*

INTRODUCTION

Musculoskeletal disorders in Indonesia represent one of the leading causes of disability, contributing substantially to reduced quality of life and work productivity (Sutopo et al., 2024; Tavakkol et al., 2020).

According to the Global Burden of Disease (GBD) Study, neck pain is among the most prevalent musculoskeletal conditions. It remains a major contributor to years lived with disability (YLDs) among the working-age population. One of the primary causes of neck pain is Myofascial Pain Syndrome (MPS), a condition characterised by the presence of Myofascial Trigger Points (MTrPs). The clinical manifestations of MTrPs include hypersensitive nodules within taut bands of skeletal muscle, localised pain, and restricted range of motion (Zhao et al., 2025).

Neck pain is commonly associated with MTrPs in the upper trapezius muscle. The upper trapezius plays a crucial role in maintaining scapular stability and supporting head and cervical posture during daily activities. Prolonged exposure to static postures, intensive use of computers and smartphones, repetitive movements, and extended periods of sitting subjects the upper trapezius to continuous submaximal contractions, thereby increasing mechanical stress on the muscle tissue. These conditions may reduce local tissue perfusion, promote the accumulation of metabolic byproducts, and facilitate the development of both active and latent MTrPs (Hidayati and Wardana 2023; Tavakkol et al. 2020).

The high prevalence of MTrPs in the upper trapezius is particularly relevant among university students. Contemporary academic activities require students to spend prolonged periods sitting while using laptops, desktop computers, and smartphones to attend lectures, complete assignments, and access digital learning resources (Kandasamy et al., 2024; Rienanda et al., 2025). Previous studies have reported that the prevalence of neck pain among university students ranges from 40% to 70%, with symptoms most frequently affecting the neck and shoulder regions. Prolonged use of digital devices has been consistently associated with the development of forward head posture and increased electromyographic activity of the upper trapezius muscle (Huey & Pillai, 2021). In addition, high academic demands may increase sympathetic nervous system activity and muscle tone (Kandasamy et al., 2024).

The therapeutic effects of dry needling (DN) are thought to involve the mechanical disruption of MTrPs. The normalisation of motor endplate activity, modulation of peripheral nociception, and activation of endogenous analgesic mechanisms. Needle insertion and manipulation induce mechanical deformation of the extracellular matrix, thereby initiating mechanotransduction processes that contribute to tissue remodelling and pain modulation (Okhovatian & Kojidi, 2018). Despite its well-established effectiveness in reducing pain and improving muscle function, DN is commonly associated with transient adverse effects following treatment (Hernández-Secorún et al., 2023).

Post-Needling Soreness (PNS) is the most frequently reported adverse event and is typically characterised by localised muscle soreness, tenderness to palpation, or mild discomfort. PNS generally develops immediately after treatment and may persist for several hours to several days before resolving spontaneously without additional intervention. Although usually mild and self-limiting, PNS may negatively affect patient comfort, adherence to treatment, and perceptions of DN effectiveness, highlighting the importance of strategies to minimise this post-treatment response (Martín-Pintado-Zugasti et al., 2018).

The severity of PNS following DN is believed to be influenced by several procedural factors, including the number of needle insertions, needle diameter, insertion depth, and needle manipulation technique. Each manipulation technique produces distinct mechanical forces within the extracellular matrix, fascial tissues, and surrounding neuromuscular structures. The In-Out technique primarily generates linear translational forces along the needle trajectory. In contrast, the Rolling technique combines translational and rotational forces, potentially enhancing needle tissue coupling, tissue deformation, and the activation of mechanosensitive nociceptors. These biomechanical differences may elicit varying inflammatory and nociceptive responses, thereby influencing the severity of PNS experienced after treatment (Martín-Pintado-Zugasti et al., 2018; Valera-Calero et al., 2024).

Despite the widespread clinical use of both techniques, direct comparative evidence regarding their effects on the severity and temporal progression of PNS remains limited. Therefore, this study aims to compare the severity of PNS between the In-Out and Rolling techniques in individuals with upper trapezius MTrPS across multiple post-intervention time points. These findings are expected to provide a better understanding of how various needle manipulation techniques affect post-treatment nociceptive responses. Thus, this study contributes to the development of DN protocols that ensure patient comfort without compromising therapeutic effectiveness in musculoskeletal rehabilitation.

METHOD

Research design

This study used a quasi-experimental design with two intervention groups to compare differences in PNS levels between the In-Out and Rolling DN techniques. The study was conducted at the Department of Physiotherapy, University of Muhammadiyah Malang, Indonesia. There were 92 participants in this study. Participants were selected based on the following inclusion criteria is being of legal age, having symptoms of MTrPs in the upper trapezius muscle, and not having taken analgesic or anti-inflammatory medication within the past 72 hours. Exclusion criteria included a history of needle allergy, open wounds or infections in the intervention area, and inability to follow the study procedures (Boyce et al., 2020).

Research procedure

A certified DN practitioner conducted the study. Before the intervention, participants underwent palpation using the Tarantula Trap method to identify MTrPs in the upper trapezius muscle. Needling sites were determined based on the results of this assessment. During the intervention, participants were positioned in a relaxed prone position with their arms at their sides or hanging off the edge of the table to ensure muscle relaxation. The procedure was performed with a 0.25 × 40 mm DN needle. The needle was inserted obliquely from posterior to anterior toward the palm to a depth of 10-20 mm, using the pincer grasp technique (Alhakami et al., 2025; Boyce et al., 2020).

In the In-Out technique group, the needle was inserted and withdrawn five times or for 10 seconds of penetration without rotation. In the Rolling technique group, the needle was inserted to the same depth, then rotated (rolled) three times before being removed. The local twitch response (LTR) was not considered a mandatory criterion. Therefore, the procedure continued even if an LTR did not occur. Needle insertion was performed at a single point without distinguishing between the dominant and non-dominant sides. PNS levels were measured at 0.5, 24, 48, and 72 hours after the intervention. Measurements were taken using a Visual Analog Scale (VAS) in millimeters (mm) (Boyce et al., 2020; Valera-Calero et al., 2024).

Data analysis

Normality in statistical analyses was assessed using the Kolmogorov-Smirnov test. A mixed ANOVA was conducted to evaluate the interaction effects between group (In-Out vs. Rolling) and time on PNS. To further compare differences between the two intervention groups at each assessment time point, the Mann-Whitney U test was used, with p-values < 0.05.

RESULT

The characteristics of the respondents, shown in table 1, include demographic factors such as age, gender, and civil servant status. Overall, the age of the In-Out technique group was 21.3 ± 1.2 years (mean ± standard deviation/SD). Meanwhile, the Rolling technique group had an average age of 21.1 ± 1.4 years. These age groups indicate that there was no significant difference in age between the groups. The gender distribution was balanced, with a male to female ratio of 12/34 in the In-Out technique group and 10/36 in the Rolling technique group. Furthermore, there were no specific differences in PNS values between the two groups: 0.8 ± 0.5 mm for the In-Out technique and 0.9 ± 0.6 mm for the Rolling technique.

Table 1. Characteristics of DN group

Characteristics	Dry Needling Group	
	In-Out Technique (n=46)	Rolling Technique (n=46)
Age (years)	21.3 ± 1.2	21.1 ± 1.4
Gender (Male/Female)	12/34	10/36
Post-Needling Soreness (PNS)	0.8 ± 0.5	0.9 ± 0.6

PNS decreased significantly over time in both DN groups. The first measurement at 0.5 hours showed a median PNS of 1.0 mm (IQR 0-2) for the In-Out technique, while the Rolling technique had a median of 2.1 mm (IQR 1-3). The narrower interquartile range (IQR) and lower median for the In-Out technique suggest that participants experienced mild PNS. Meanwhile, half of the participants in the Rolling technique group still experienced moderate PNS. The Mann-Whitney test supported these findings with an effect test (F) value of 5.17 and a p value of 0.026. These results indicate that the In-Out Technique resulted in milder initial PNS that remained well controlled.

Table 2. Change in PNS intensity

Time PNS (h)	Dry Needling Group		F	*p* (Between-Group)	*p* (Within-Group)
	In-Out Technique (n=46)	Rolling Technique (n=46)			
0.5	1.0 (0-2)	2.1 (1-3)	5.17	0.026	<0.0001
24	1.5 (1-2)	1.6 (1-3)	0.22	0.642	
48	1.0 (1-1)	1.0 (1-2)	0.01	0.930	
72	1.0 (1-1)	1.2 (1-2)	0.38	0.540	

Differences in PNS following DN between the In-Out and Rolling techniques were analysed using a two-way mixed ANOVA with four assessment time points (0.5, 24, 48, and 72 hours post-intervention).

Between group analysis demonstrated a significant difference at 0.5 hours post-intervention ($p = 0.026$), with the Rolling technique producing significantly greater PNS than the In-Out technique. However, no significant between group differences were observed at 24, 48, or 72 hours (all $p>0.05$). These findings indicate that the influence of needle manipulation technique on PNS was limited to the immediate post-treatment period. In contrast, both techniques showed comparable levels of PNS during the subsequent recovery phase.

Within group analysis showed a significant reduction in PNS over time in the Rolling technique group ($p<0.001$), indicating progressive resolution of soreness from 0.5 to 72 hours following the intervention. A similar pattern was observed in the In-Out technique group, which also demonstrated a significant decline in PNS across all follow-up assessments. These findings suggest that although the Rolling technique elicited greater acute post-needling soreness, both techniques exhibited a similar recovery trajectory, with PNS progressively decreasing over the 72 hour follow-up period.

Table 3. Mixed ANOVA test

	df	F	p	η^2p
DN Technique	1.90	4.92	0.029	0.05
Time vs. PNS	3.27	12.34	<0.001	0.12
DN Technique vs. Time PNS	3.27	0.87	0.456	0.01

The mixed ANOVA in table 3 revealed a significant main effect of the dry needling technique on PNS ($p=0.029$, $\eta^2p=0.05$), indicating a significant difference in mean PNS between the In-Out and Rolling techniques. A significant main effect of time was also observed ($p<0{,}001$, $\eta^2p=0{,}12$), demonstrating that PNS progressively decreased over the follow-up period regardless of the intervention technique. However, the interaction effect between dry needling technique and time was not statistically significant ($p=0{,}456$, $\eta^2p=0{,}01$). These findings indicate that although the two dry needling techniques differed in overall PNS intensity, the temporal pattern of PNS reduction was comparable between groups throughout the 72 hour follow-up period.

DISCUSSION

The Rolling Technique group exhibited higher PNS intensity compared to the In-Out Technique group 0.5 hours after the intervention. However, this difference was no longer observed at the 24, 48, and 72 hour time. In addition, both groups showed a significant decrease in PNS over time. The results of the mixed ANOVA analysis confirmed significant effects of the dry needling technique and time on PNS changes. Meanwhile, the interaction between technique and time was not significant. Differences in needle manipulation techniques affected pain intensity in the acute post-procedure phase but did not alter the pain pattern over the 72 hours.

The present study is consistent with previous reports identifying PNS as the most common transient adverse event following DN. Existing evidence indicates that PNS generally peaks within the first few hours after treatment and progressively diminishes over the subsequent 24-72 hours, with most individuals experiencing only mild to moderate discomfort. The severity of PNS is influenced not only by tissue injury resulting from needle insertion but also by the characteristics of needle manipulation. This interpretation supports the findings of the present study, which showed that the Rolling technique produced greater soreness during the acute post-intervention period than the In-Out technique. However, these differences disappeared as the natural recovery process progressed (Martín-Pintado-Zugasti et al., 2018).

The greater severity of PNS observed in the Rolling technique group is likely attributable to the greater mechanical deformation imposed on myofascial tissues during the intervention. In the In-Out technique, the needle primarily generates linear translational forces along its insertion trajectory. In contrast, the Rolling technique introduces additional torsional forces that promote needle tissue coupling and collagen winding within the extracellular matrix. As the needle rotates, collagen fibres, intramuscular fascia, and perimysial connective tissues undergo rotational deformation rather than simple linear displacement. This mechanical loading increases the distribution of tissue strain surrounding the needle, thereby stimulating a greater number of high-threshold mechanoreceptors and polymodal nociceptors. The activation of these receptors enhances afferent input and contributing to the higher intensity of soreness during the acute PNS (Fernández-De-Las-Peñas & Nijs, 2019; Seif et al., 2025).

Mechanical deformation generated during needle manipulation is known to activate mechanosensitive ion channels, including Piezo1, Piezo2, transient receptor potential vanilloid 1 (TRPV1), and transient receptor potential ankyrin 1 (TRPA1). The activation of these mechanotransducers facilitates Na^+ and Ca^{2+} influx into peripheral nociceptors, lowering neuronal activation thresholds and amplifying local nociceptive excitability (Dommerholt, 2011). Given that the Rolling technique produces greater rotational tissue strain and needle tissue coupling than the In-Out technique. It is plausible that a larger number of mechanosensitive nociceptors are recruited, thereby increasing afferent nociceptive signaling during the acute post-treatment period. This neurophysiological response provides a mechanistic explanation for the higher intensity of PNS immediately after the Rolling technique (Altier, 2015; Chang et al., 2020).

The absence of significant differences between the two groups at 24, 48, and 72 hours post-intervention suggests that the greater initial inflammatory response elicited by the Rolling technique did not progress into prolonged nociceptive sensitisation. As the acute inflammatory phase resolved, pro-inflammatory mediators were gradually cleared by macrophages and local lymphatic drainage. In contrast, anti-inflammatory mediators, including interleukin-10 (IL-10) and transforming growth factor-β (TGF-β), became increasingly dominant within the tissue microenvironment. In addition, both dry needling techniques may have activated comparable endogenous analgesic mechanisms via the descending pain-modulatory system, involving the periaqueductal grey (PAG), the rostral ventromedial medulla (RVM), and the neurotransmitters serotonin and norepinephrine (Altier, 2015; Dommerholt, 2011).

Activation of these descending inhibitory pathways suppresses nociceptive transmission at the dorsal horn of the spinal cord, thereby contributing to the progressive reduction in soreness observed in both groups over time. These findings suggest that although different needle manipulation techniques may produce distinct levels of acute mechanical stimulation, the subsequent neurophysiological recovery processes appear to converge, resulting in a similar trajectory of symptom resolution (Seif et al., 2025). Furthermore, previous studies have demonstrated that the severity of PNS is influenced not only by the extent of mechanical tissue stimulation but also by pre-intervention tissue stiffness, pain experienced during needle insertion, and patient expectations. From a contemporary pain neuroscience perspective, pain perception is not solely determined by peripheral nociceptive input but also reflects the brain's predictive processing and interpretation of perceived tissue threat, which may partially explain the variability in soreness responses among individuals (Dommerholt, 2011; Valera-Calero et al., 2024).

Both DN techniques demonstrated a comparable pattern of soreness recovery over the 72 hour follow-up period. Nevertheless, the In-Out technique produced lower soreness intensity during the acute post-treatment phase, suggesting that it may be a more suitable option for individuals with heightened pain sensitivity, fear-avoidance behaviours, or those requiring a rapid return to functional activities following treatment. Selecting an appropriate needle manipulation technique should consider not only therapeutic effectiveness but also patient comfort and treatment adherence, as minimizing early post-treatment discomfort may improve the overall rehabilitation experience (Okhovatian & Kojidi, 2018).

This study has several limitations that should be acknowledged. First, the investigation was limited to myofascial trigger points in the upper trapezius. Therefore, the findings should be generalised to other muscle groups with caution. Second, the primary outcome focused exclusively on the intensity of PNS measured using the VAS, without incorporating objective physiological or functional outcome measures. Future studies should integrate multimodal assessments to provide a more comprehensive understanding of the mechanisms PNS. Despite these limitations, the comparative study design and repeated assessments at four time points over 72 hours provide a detailed characterisation of the temporal progression of PNS following DN, thereby strengthening the clinical relevance of the present findings (Boyce et al., 2020).

CONCLUSIONS

This study shows a difference in PNS levels between the In-Out and Rolling DN techniques in the early phase following the intervention. At the 0.5 hour measurement point following the procedure, the In-Out technique group had lower PNS levels than the Rolling technique group. These findings indicate that the In-Out technique results in a milder post-procedural pain response during the acute period following dry needling.

However, these differences were no longer observed at the 24, 48, and 72 hour time following the intervention. Both techniques demonstrated a significant decrease in PNS intensity over time. This suggests that the post-DN pain effect is temporary and tends to resolve naturally within a few days after the procedure. Both DN techniques can be used safely and are well tolerated. However, if the goal of the intervention is to minimize patient discomfort immediately after the procedure, the In-Out technique may be a more advantageous option compared to the Rolling technique.

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