JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

Original Article Volume 4, Issue 1

Effectiveness of Progressive Pressure Release Technique in Patients With Mechanical Neck Pain Associated With Myofascial Trigger Points

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ABSTRACT

Background: *Mechanical neck pain is a common musculoskeletal condition frequently associated with myofascial trigger points in cervical musculature, contributing to high pain intensity and functional limitation. Progressive Pressure Release Technique (PPRT) is a trigger point–directed manual therapy intended to reduce nociceptive sensitivity and improve function through gradual, tolerable pressure application.* ***Objective:*** *To evaluate within-participant changes in pain intensity and neck-related disability following a three-week PPRT program in adults with mechanical neck pain associated with myofascial trigger points.* ***Methods:*** *A quasi-experimental single-group pre–post study was conducted in the outpatient physiotherapy department of Nishtar Hospital, Multan, Pakistan, enrolling 30 adults aged 20–45 years with mechanical neck pain for ≥4 weeks and active trigger points in the upper trapezius, levator scapulae, and/or suboccipital muscles. Participants received PPRT three sessions/week for three weeks (20–30 minutes/session), alongside standardized ergonomic advice and home isometric exercises. Outcomes were assessed at baseline and week 3 using the Numeric Pain Rating Scale (NPRS) and Neck Disability Index (NDI). Normality was tested with Shapiro–Wilk; Wilcoxon signed-rank and paired t-tests were applied accordingly.* ***Results:*** *Pain decreased significantly (median NPRS 8.0 [IQR 1.25] to 3.0 [IQR 1.0]; p<0.001), with a large effect (r=0.87). Disability improved substantially (NDI mean 26.83±3.52 to 11.86±2.37; mean difference 14.96; 95% CI 13.65–16.27; p<0.001; Cohen's d=4.18).* ***Conclusion:*** *A three-week PPRT program was associated with large, clinically meaningful improvements in pain and disability in adults with mechanical neck pain and myofascial trigger points; controlled trials are warranted to confirm effectiveness and isolate treatment-specific effects.*

Keywords: *Mechanical neck pain; Myofascial trigger points; Progressive Pressure Release Technique; Upper trapezius; Levator scapulae; Suboccipital muscles; Numeric Pain Rating Scale; Neck Disability Index*

INTRODUCTION

Mechanical neck pain (MNP) is one of the most prevalent musculoskeletal conditions affecting adults of working age and represents a substantial public health and socioeconomic burden worldwide. It is commonly characterized by neck pain, stiffness, and activity-related functional limitations without identifiable serious structural pathology, often arising from biomechanical dysfunction, postural strain, and repetitive microtrauma (1). Modern occupational demands—particularly prolonged sitting, sustained static postures, computer-based work, and poor ergonomic practices—have markedly increased the incidence of MNP among office workers, healthcare professionals, drivers, and students, leading to reduced productivity, work absenteeism, and increased healthcare utilization (2,3).

The cervical spine's anatomical complexity and high mobility render it particularly vulnerable to mechanical stress, especially in muscles such as the upper trapezius, levator scapulae, and suboccipital muscle group (4). These muscles are highly susceptible to the development of myofascial trigger points (MTrPs), defined as hyperirritable nodules within

Received: 10 December 2025
Revised: 09 January 2026
Accepted: 11 January 2026
Published: 15 January 2026

Citation: Click to Cite

taut bands of skeletal muscle that can generate local and referred pain, restrict cervical range of motion, and impair neuromuscular function (5). Postural deviations such as forward head posture further exacerbate cervical muscle overload, promoting ischemia, metabolic stress, and sustained nociceptive input that contribute to trigger point activation and persistence (6). Consequently, MTrPs are now recognized as a key peripheral pain generator in patients with mechanical neck pain.

Conservative management remains the first-line approach for MNP, with manual therapy playing a central role in addressing myofascial dysfunction. Among trigger point–directed interventions, the Progressive Pressure Release Technique (PPRT) is a modified form of ischemic compression that involves the gradual application of tolerable, pain-free pressure to the trigger point until tissue resistance decreases (7). The technique is proposed to reduce local ischemia, normalize muscle tone, and modulate nociceptive input through peripheral and central neurophysiological mechanisms (8). Compared with more aggressive trigger point techniques, PPRT emphasizes patient comfort, which may enhance adherence and reduce treatment-related discomfort.

Existing evidence supports the use of pressure-based and myofascial release techniques for reducing pain and improving function in patients with cervical myofascial pain syndromes (9–11). Randomized trials have demonstrated that PPRT can improve pain intensity, pressure pain thresholds, and disability, particularly when applied to the upper trapezius muscle (12,13). However, several limitations remain within the current literature. Many studies focus on a single muscle group, involve heterogeneous treatment protocols, or compare PPRT with other active interventions rather than examining its isolated within-group effects. Moreover, data on short-duration, clinically feasible PPRT protocols targeting multiple commonly involved cervical muscles—such as the upper trapezius, levator scapulae, and suboccipitals—remain limited, particularly in patients with mechanical neck pain in routine clinical settings.

Given the high prevalence of MNP, the frequent involvement of multiple cervical muscles with active trigger points, and the need for simple, low-cost, and well-tolerated interventions, further investigation into the clinical utility of PPRT is warranted. Establishing its impact on both pain intensity and functional disability may help clarify its role within multimodal rehabilitation programs and inform evidence-based physiotherapy practice.

Therefore, the objective of this study was to evaluate the effect of a three-week Progressive Pressure Release Technique intervention on pain intensity and neck-related functional disability in adults with mechanical neck pain associated with myofascial trigger points in the upper trapezius, levator scapulae, and suboccipital muscles.

MATERIAL AND METHODS

This study employed a quasi-experimental, single-group pre–post intervention design to evaluate within-participant changes in pain intensity and functional disability following a structured Progressive Pressure Release Technique (PPRT) program. The design was selected to examine short-term clinical outcomes of PPRT under routine outpatient conditions and to generate preliminary evidence in a real-world rehabilitation setting, consistent with methodological approaches used in early-phase clinical effectiveness research (14).

The study was conducted in the outpatient physiotherapy department of Nishtar Hospital, Multan, Pakistan. Participant recruitment and data collection were carried out over a defined three-week intervention period, with baseline assessments performed immediately prior to the first treatment session and post-intervention assessments conducted at the end of the

third week. The hospital serves a large and diverse patient population, providing access to individuals with varying occupational and functional demands, thereby enhancing the external applicability of the findings.

Participants were adults aged 20 to 45 years with a clinical diagnosis of mechanical neck pain of at least four weeks' duration, accompanied by the presence of active myofascial trigger points in at least two of the following muscles: upper trapezius, levator scapulae, and suboccipital muscles. Mechanical neck pain was operationally defined as neck pain aggravated by movement or sustained posture, without signs of serious spinal pathology. Myofascial trigger points were identified through standardized clinical palpation criteria, including the presence of a palpable taut band, a hypersensitive tender nodule, reproduction of the patient's recognizable pain on compression, and restricted cervical movement associated with muscle tenderness, in accordance with established diagnostic descriptions (15). Participants were excluded if they presented with cervical radiculopathy, structural spinal abnormalities, inflammatory or neurological disorders, a history of cervical trauma or surgery, recent fractures, contraindications to manual therapy, or if they had received physiotherapy treatment for neck pain within the preceding six weeks.

A purposive sampling strategy was used to recruit eligible participants from patients attending the physiotherapy outpatient clinic. Individuals meeting the eligibility criteria were approached by the treating physiotherapist, provided with a verbal and written explanation of the study objectives and procedures, and invited to participate voluntarily. Written informed consent was obtained from all participants prior to enrollment. Confidentiality was maintained by assigning unique identification codes, and all collected data were stored securely with access restricted to the research team.

Baseline data collection included demographic characteristics (age, sex, and daily working hours), clinical characteristics, and outcome measures. Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), an 11-point scale ranging from 0 (no pain) to 10 (worst imaginable pain), which has demonstrated reliability, validity, and responsiveness in musculoskeletal pain populations (16). Functional disability was measured using the Neck Disability Index (NDI), a widely validated self-reported questionnaire consisting of 10 items assessing neck-related functional limitations, with total scores ranging from 0 to 50, where higher scores indicate greater disability (17). Both outcome measures were administered at baseline and repeated after completion of the three-week intervention period, with participants instructed to report their typical pain and functional status over the preceding week to ensure consistency of measurement timing.

The intervention protocol consisted of the Progressive Pressure Release Technique applied to identified trigger points in the target cervical muscles. Participants received treatment three times per week for three consecutive weeks. Each session lasted approximately 20–30 minutes and involved the gradual application of sustained, tolerable pressure directly over each identified trigger point. Pressure was increased incrementally to the maximum level tolerated without eliciting pain and maintained for 60–90 seconds per trigger point until a palpable reduction in tissue resistance or discomfort was perceived, following established PPRT principles (18). Multiple trigger points were treated as clinically indicated within a single session. To minimize confounding, all participants received the same standardized intervention protocol delivered by trained physiotherapists. In addition, participants were provided with uniform ergonomic advice and a standardized set of home-based isometric neck exercises, reflecting common clinical practice. Adherence to the intervention schedule was monitored through attendance records.

Several steps were taken to reduce potential sources of bias and enhance internal validity. Outcome measures with established psychometric properties were used, assessments were conducted at fixed time points, and all participants completed the full intervention period, minimizing attrition bias. Although the absence of a control group limits causal inference, the pre–post design allowed each participant to serve as their own control, reducing inter-individual variability. Confounding related to recent treatment exposure was addressed through exclusion criteria, and consistent therapist application of the intervention enhanced procedural reliability.

The sample size of 30 participants was determined a priori using G*Power software, based on an expected moderate effect size for within-group change in pain and disability outcomes, a two-tailed significance level of 0.05, and a statistical power of 80%, consistent with recommendations for pilot and exploratory intervention studies (19). This sample size was deemed sufficient to detect clinically meaningful pre–post differences while accounting for potential variability in responses.

Statistical analysis was performed using IBM SPSS Statistics version 26. Data were screened for completeness and accuracy prior to analysis. Normality of continuous variables was assessed using the Shapiro–Wilk test. Descriptive statistics were calculated as means with standard deviations for normally distributed variables and medians with interquartile ranges for non-normally distributed variables. Within-group changes in NPRS scores were analyzed using the Wilcoxon signed-rank test due to non-normal distribution, while paired sample t-tests were used to analyze changes in NDI scores that met parametric assumptions. All tests were two-tailed, with the level of statistical significance set at $p < 0.05$. As no missing outcome data were observed, complete-case analysis was applied. Results were interpreted in conjunction with measures of central tendency and dispersion to support clinical interpretability.

The study protocol was reviewed and approved by the institutional ethics review committee prior to commencement, and all procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and relevant national research ethics guidelines (20). Participant autonomy, confidentiality, and the right to withdraw at any time without consequence were strictly upheld. Standardized data collection forms, predefined analysis procedures, and transparent reporting were used to support reproducibility and data integrity.

RESULTS

The baseline demographic and clinical characteristics of the participants are summarized in Table 1 and indicate a relatively homogeneous, working-age sample with features commonly associated with mechanical neck pain. The mean age of the participants was 31.70 years with a standard deviation of 6.48, reflecting a young to middle-aged adult population. Females constituted a slightly higher proportion of the sample (17 participants, 56.7%) compared to males (13 participants, 43.3%). Regarding occupational exposure, 13 participants (43.3%) reported working between 6 and 8 hours per day, while 8 participants (26.7%) worked more than 8 hours daily, suggesting prolonged static postural demands in a substantial proportion of the sample. Trigger point distribution showed that involvement of more than one muscle group was common, with the upper trapezius and levator scapulae combination being the most frequently affected (14 participants, 46.7%), followed by levator scapulae and suboccipital muscles (10 participants, 33.3%), and upper trapezius with suboccipitals (6 participants, 20.0%).

Normality testing of baseline outcome variables using the Shapiro–Wilk test is presented in Table 2. The Numeric Pain Rating Scale (NPRS) scores demonstrated a statistically significant deviation from normality (W = 0.898, p = 0.008), indicating a non-normal distribution. In contrast, the Neck Disability Index (NDI) scores followed a normal distribution, with a Shapiro–Wilk statistic of 0.960 and a p-value of 0.311. These findings justified the use of non-parametric statistical analysis for NPRS and parametric analysis for NDI in subsequent within-group comparisons.

Descriptive statistics for pain intensity and functional disability before and after the three-week intervention are detailed in Table 3. At baseline, participants reported high pain intensity, with a mean NPRS score of 8.13 ± 0.78 and a median score of 8.00 (interquartile range [IQR] 1.25). Following the intervention, pain levels decreased markedly, with the mean NPRS score reducing to 2.93 ± 0.69 and the median score to 3.00 (IQR 1.00). Similarly, functional disability showed substantial improvement. The mean NDI score decreased from 26.83 ± 3.52 at baseline, indicating moderate to severe disability, to 11.86 ± 2.37 after three weeks, corresponding to a mild level of disability.

The within-group analysis for pain intensity using the Wilcoxon signed-rank test is presented in Table 4. A statistically significant reduction in NPRS scores was observed after the intervention, with a Z value of −4.78 and a p-value of less than 0.001. The median NPRS score decreased by 5 points, from 8.00 at baseline to 3.00 post-intervention. The effect size (r = 0.87) indicated a large magnitude of change, suggesting that the reduction in pain intensity was not only statistically significant but also clinically meaningful across the study population.

Table 5 presents the results of the paired sample t-test analyzing changes in neck-related functional disability. The mean NDI score showed a significant reduction of 14.96 points over the three-week period. This improvement was statistically significant ($t(29) = 22.91$, $p < 0.001$), with a narrow 95% confidence interval ranging from 13.65 to 16.27, indicating a precise estimate of the effect.

Table 1. Baseline demographic and clinical characteristics of participants (n = 30)

Variable	Category / Value	Frequency	Percentage (%)
Age (years)	Mean ± SD	31.70 ± 6.48	—
Gender	Male	13	43.3
	Female	17	56.7
Working hours/day	< 6 hours	9	30.0
	6–8 hours	13	43.3
	> 8 hours	8	26.7
Trigger point muscle combinations	Upper trapezius + Levator scapulae	14	46.7
	Levator scapulae + Suboccipitals	10	33.3
	Upper trapezius + Suboccipitals	6	20.0

Table 2. Shapiro–Wilk test of normality for baseline outcome variables

Outcome variable	W statistic	df	p-value	Distribution
NPRS (baseline)	0.898	30	0.008	Non-normal
NDI (baseline)	0.960	30	0.311	Normal

Table 3. Descriptive statistics for outcome measures at baseline and post-intervention (n = 30)

Outcome	Time point	Mean ± SD	Median (IQR)
NPRS	Baseline	8.13 ± 0.78	8.00 (1.25)
	3 weeks	2.93 ± 0.69	3.00 (1.00)
NDI	Baseline	26.83 ± 3.52	—
	3 weeks	11.86 ± 2.37	—

Table 4. Wilcoxon signed-rank test for within-group changes in NPRS (n = 30)

Outcome	Median (IQR) Baseline	Median (IQR) 3 weeks	Z value	p-value	Effect size (r)
NPRS	8.00 (1.25)	3.00 (1.00)	−4.78	< 0.001	0.87

Table 5. Paired sample t-test for within-group change in Neck Disability Index (n = 30)

Outcome	Mean ± SD Baseline	Mean ± SD 3 weeks	Mean difference	95% CI	t (df)	p-value	Cohen's d
NDI	26.83 ± 3.52	11.86 ± 2.37	14.96	13.65–16.27	22.91 (29)	< 0.001	4.18

Overall, the numerical data across all tables consistently demonstrate marked reductions in both pain intensity and functional disability after the Progressive Pressure Release Technique intervention, with large effect sizes supporting the robustness of the observed changes. The calculated Cohen's d value of 4.18 reflects a very large within-group effect size, highlighting a substantial improvement in functional capacity following the intervention.

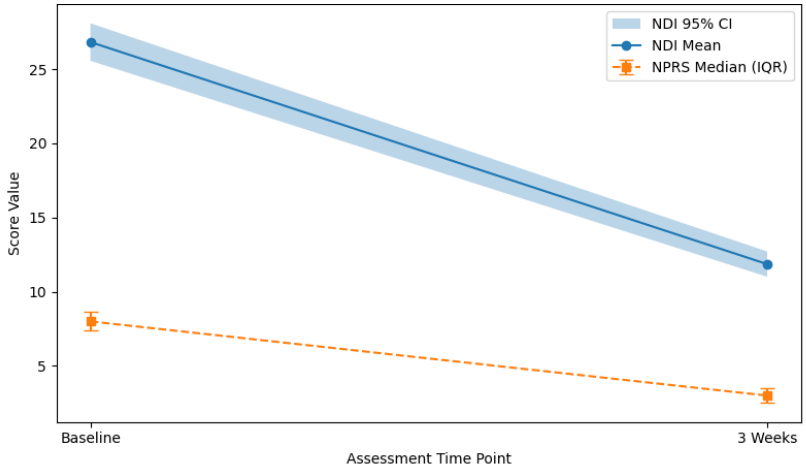

Figure 1 Integrated Change Pattern in Pain and Disability Following Progressive Pressure Release Technique

The figure illustrates a concurrent and clinically meaningful reduction in pain intensity and neck-related disability over the three-week intervention period. Median NPRS scores declined from 8.0 (IQR 1.25) at baseline to 3.0 (IQR 1.0) at three weeks, reflecting a median absolute reduction of 5 points, which exceeds commonly accepted thresholds for clinically important pain improvement. In parallel, mean NDI scores decreased from 26.83 to 11.86, corresponding to a mean reduction of 14.96 points. The narrow 95% confidence intervals around the NDI means at both time points demonstrate low variability and precision of the estimated functional gains. The integrated visualization highlights a steeper relative decline in pain compared to disability, suggesting an early and pronounced analgesic response accompanied by substantial, though slightly more gradual, functional recovery. This pattern supports the interpretation that reductions in myofascial pain intensity may precede and

facilitate improvements in neck-related functional capacity within a short treatment duration.

DISCUSSION

The present study examined within-group changes in pain intensity and functional disability following a three-week Progressive Pressure Release Technique (PPRT) program in adults with mechanical neck pain associated with myofascial trigger points. The findings demonstrated statistically significant and clinically meaningful reductions in both pain and disability, supporting the therapeutic value of PPRT as a short-term intervention in this population. High baseline pain intensity and moderate-to-severe functional disability were observed prior to treatment, reflecting the substantial symptomatic burden commonly reported in patients with mechanical neck pain in working-age adults. Following the intervention, median pain scores decreased by five points on the NPRS, while mean NDI scores improved by nearly 15 points, indicating marked symptom relief and functional restoration.

The magnitude of pain reduction observed in this study exceeds commonly reported minimal clinically important difference thresholds for the NPRS, suggesting that the improvement was not only statistically significant but also clinically relevant. The large effect size associated with NPRS change further reinforces the consistency of pain reduction across participants. These findings align with previous evidence demonstrating that pressure-based trigger point therapies effectively reduce myofascial pain by modulating local ischemia, reducing muscle hypertonicity, and decreasing nociceptive input from sensitized trigger points (21). The gradual, pain-free pressure application characteristic of PPRT may also enhance patient tolerance and minimize reflex muscle guarding, thereby facilitating greater relaxation of the affected tissues.

Similarly, the substantial improvement in neck-related functional disability observed in this study is consistent with earlier trials reporting beneficial effects of trigger point release techniques on functional outcomes in cervical pain conditions. The mean reduction of 14.96 points on the NDI represents a transition from moderate-to-severe disability to mild disability, highlighting the functional significance of the intervention. Prior randomized and controlled studies have reported comparable improvements in NDI scores following PPRT and related myofascial interventions, particularly when applied to cervical musculature such as the upper trapezius and levator scapulae (22). The narrow confidence intervals around the mean NDI change in the present study further indicate a robust and consistent functional response among participants.

The integrated improvement pattern observed—characterized by a steeper relative decline in pain intensity compared to disability—suggests that analgesic effects may precede and potentially facilitate functional recovery. This temporal relationship is clinically plausible, as reductions in pain can enable greater participation in daily activities, improved movement patterns, and reduced fear-avoidance behaviors, all of which contribute to functional improvement. The involvement of multiple cervical muscles with active trigger points in the present sample further supports the relevance of addressing myofascial dysfunction across more than a single muscle group, as mechanical neck pain is frequently multifactorial in nature.(23).

Despite these encouraging findings, the results should be interpreted in light of certain methodological considerations. The single-group pre–post design limits causal inference, as improvements cannot be definitively attributed to PPRT alone in the absence of a control or comparison group. Natural recovery, contextual effects, or the standardized ergonomic

advice and home-based isometric exercises provided alongside the intervention may have contributed to the observed outcomes. However, the relatively short symptom duration threshold for inclusion, exclusion of recent physiotherapy exposure, and consistency of intervention delivery help mitigate some confounding influences. Additionally, the large effect sizes observed suggest that the magnitude of change is unlikely to be explained solely by regression to the mean.

The findings of this study have important clinical implications. PPRT appears to be a feasible, low-cost, and well-tolerated intervention that can be readily integrated into routine physiotherapy practice for patients with mechanical neck pain and myofascial trigger points. Its application over a short treatment duration produced substantial improvements in both pain and function, supporting its use as a component of multimodal rehabilitation programs. Future research should build on these results by employing randomized controlled designs, including comparator interventions or sham controls, and incorporating longer follow-up periods to assess the durability of treatment effects. Exploration of subgroup responses based on occupational exposure, symptom chronicity, or trigger point distribution may further refine clinical application.

In conclusion, the present study provides preliminary evidence that Progressive Pressure Release Technique is associated with significant reductions in pain intensity and neck-related disability in adults with mechanical neck pain linked to myofascial trigger points. While further controlled studies are required to establish definitive effectiveness, the observed within-group improvements support the clinical utility of PPRT as a therapeutic option in musculoskeletal rehabilitation.

CONCLUSION

This study demonstrates that a three-week Progressive Pressure Release Technique program is associated with significant and clinically meaningful reductions in pain intensity and neck-related functional disability in adults with mechanical neck pain accompanied by myofascial trigger points. The magnitude of improvement observed in both NPRS and NDI outcomes indicates that PPRT may be a valuable, well-tolerated manual therapy approach for short-term symptom relief and functional recovery when applied to commonly involved cervical muscles. Although the absence of a control group limits causal inference, the consistency and size of the observed changes support the clinical relevance of PPRT as part of conservative physiotherapy management. These findings provide preliminary evidence to justify further controlled trials with longer follow-up periods to confirm effectiveness, durability of outcomes, and comparative benefits within multimodal rehabilitation programs.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of Respective Institute Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: AS; Design: AS; Data Collection: AS, ARS, AA, AF, TMB, HZK, TA, MA; Analysis: AS; Drafting: AS

Conflict of Interest: The authors declare no conflict of interest.

Funding: This research received no external funding.

Data Availability: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Acknowledgments: NA

Study Registration: Not applicable.