(ISSN: 0973-7049(P))

The Bioscan AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES 21(1): S.I (1), 1304-1317, 2026 www.thebioscan.com

Effectiveness of Dry Needling Combined with Isometric Exercises on Cervical Muscle Groups in Individuals with Non-Specific Neck Pain

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DOI: https://doi.org/10.63001/tbs.2026.v21.i01.S.I(1).pp1304-1317

KEYWORDS

Non-specific neck pain; Dry needling; Isometric exercise; Cervical muscles; Rehabilitation

Article Info

Received: 24.02.2026

Accepted: 11.03.2026

Published: 22.03.2026

Abstract

Background:
Non-specific neck pain (NSNP) is a common musculoskeletal disorder causing pain and functional limitation. Dry needling and isometric exercises are widely used, but evidence on their combined effectiveness across cervical muscle groups is limited.

Objective:
To evaluate the effectiveness of dry needling combined with isometric exercises in different cervical muscle groups in individuals with NSNP.

Methods:
A randomized experimental study was conducted on 50 participants (18–50 years). Participants were divided into Group A (anterior + lateral) and Group B (posterior + lateral). Both groups received dry needling and isometric exercises for 2–4 weeks. Outcomes were measured using VAS and NDI. Statistical analysis included paired and independent t-tests ($p < 0.05$).

Results:
Both groups showed significant improvement in pain and disability ($p < 0.001$). No significant difference was found between groups ($p > 0.05$).

Conclusion:
Combined dry needling and isometric exercise therapy is effective regardless of targeted cervical muscle group.

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INTRODUCTION

Non-specific neck pain (NSNP) is one of the most prevalent musculoskeletal disorders worldwide, affecting individuals across a wide range of age groups and occupational settings. It is characterized by pain and discomfort in the cervical region without a clearly identifiable pathological cause. A large proportion of the population experiences neck pain at some point in life, with increasing incidence attributed to modern lifestyle factors such as prolonged screen exposure, poor ergonomic posture, and reduced physical activity levels.

The cervical spine relies on the coordinated function of anterior, posterior, and lateral muscle groups to maintain stability, support head posture, and facilitate movement. Any imbalance or dysfunction in these muscle groups can lead to altered biomechanics, impaired neuromuscular control, and persistent pain. Additionally, myofascial trigger points commonly develop in cervical musculature, contributing to localized and referred pain patterns as well as reduced functional capacity.

Dry needling has emerged as an effective intervention for managing myofascial pain by targeting trigger points, improving local blood circulation, and modulating pain through neurophysiological mechanisms. Concurrently, isometric exercises are widely used in rehabilitation to enhance muscle strength, endurance, and cervical stability without placing excessive stress on joints. These exercises are particularly beneficial in restoring neuromuscular coordination and preventing recurrence of symptoms.

While both dry needling and isometric exercises have demonstrated individual effectiveness in the management of NSNP, there is limited evidence regarding their combined effect when applied to different cervical muscle groups. Understanding whether targeting anterior versus posterior muscle groups yields differential outcomes is important for optimizing rehabilitation strategies.

Therefore, the present study aims to evaluate the effectiveness of dry needling combined with isometric exercises in different cervical muscle groups in individuals with non-specific neck pain.

MATERIALS AND METHODS

Study Design

A randomized experimental study was conducted to evaluate the effectiveness of dry needling combined with isometric exercises on cervical muscle groups in individuals with non-specific neck pain.

Study Setting

The study was carried out in the Department of Physiotherapy at Pacific Medical College and Hospital, Udaipur, Rajasthan, India.

Sample Size

A total of 50 participants were recruited for the study.

Participant Selection

Inclusion Criteria

- Individuals aged between 18 and 50 years
- Diagnosed with non-specific neck pain
- Both male and female participants
- Willingness to participate in the study

Exclusion Criteria

- Presence of structural cervical pathology
- Neurological disorders
- History of recent trauma or cervical surgery
- Contraindications to dry needling

Randomization and Group Allocation

Participants were randomly allocated into two groups using a simple randomization method:

Group A: Dry needling combined with isometric exercises targeting anterior and lateral cervical muscles

Group B: Dry needling combined with isometric exercises targeting posterior and lateral cervical muscles

INTERVENTION PROTOCOL

Dry Needling

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Dry needling was applied to identified myofascial trigger points in the cervical musculature using sterile techniques.
Frequency: 1–2 sessions per week
Duration: 2–4 weeks

Isometric Exercises

Participants performed cervical isometric exercises targeting the respective muscle groups.
Repetitions: 8–10 per session
Hold duration: 5–10 seconds
Frequency: Daily or on alternate days

OUTCOME MEASURES

Pain Intensity: Assessed using the Visual Analog Scale (VAS)
Functional Disability: Assessed using the Neck Disability Index (NDI)

STATISTICAL ANALYSIS

Data were analyzed using appropriate statistical methods.
Paired t-test was used for within-group comparisons
Independent t-test was used for between-group comparisons
The level of statistical significance was set at $p < 0.05$

Result

Table 1 Distribution of Age Group

Age	Number of Patients	Percentage
15-20	4	8%
20-25	9	18%
25-30	12	24%
30-35	9	18%
35-40	7	14%
40 -45	6	12%
45-50	3	6%
Total	**50**	**100**

Out of 50 patients studied, 4(8%) had their age between 15-20years,9(18%) had age between 20-25years,12(24%) had age between 25-30years,9(18%) had age between30-35 years,7(14%) had age between35-40years, 6(12%) had age 40-45 years,3(6%)had age between 45-50years. Mean ± SD of age in the entire study group was 30.7 ± 7.8 Years and minimum-maximum age range was 19-45 years.

Diagram 1 Showing the bar diagram distribution of age group

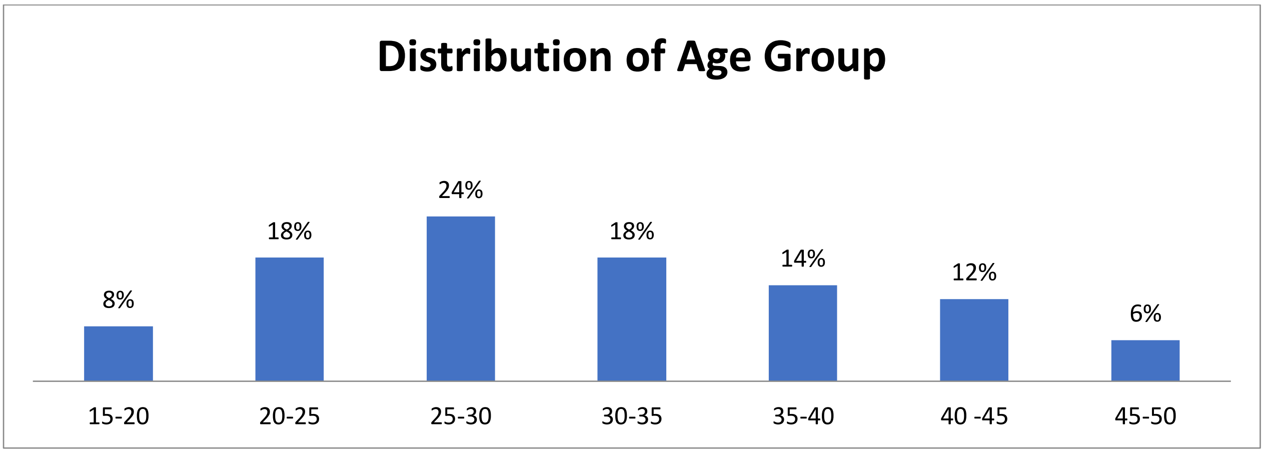

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Table 2 Distribution of Gender

Gender	Number of Patients	Percentage
Male	25	50%
Female	25	50%
Total	**50**	**100%**

Out of 50 patients studied, 25(50%) had male, 25(50%) had female.

Diagram 2 Showing the Pie diagram distribution of gender

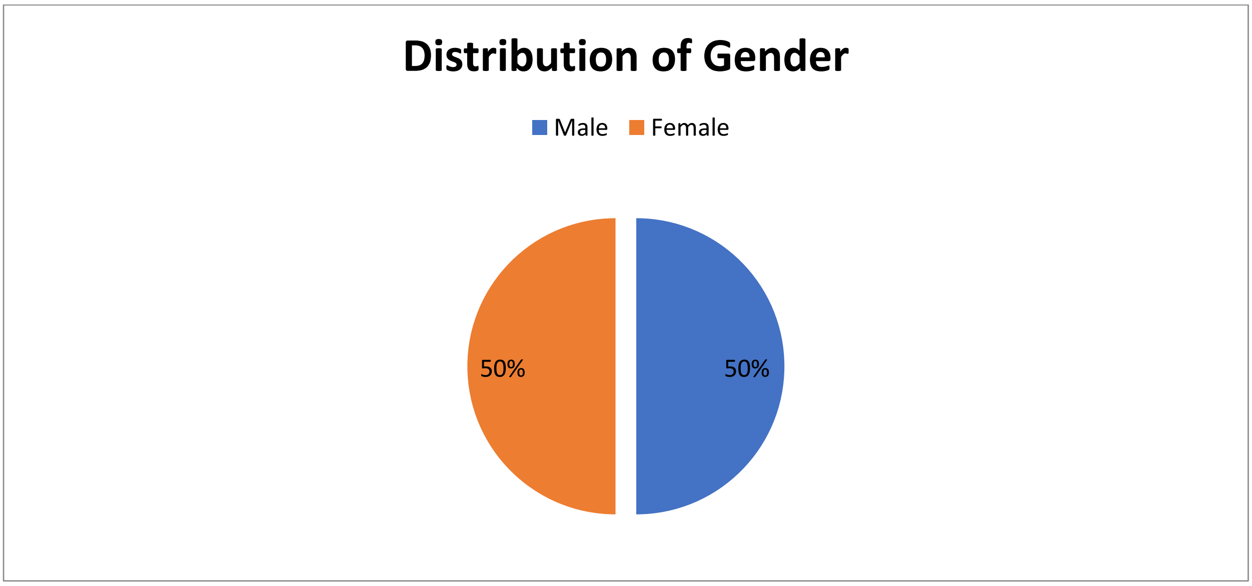

Table 3 Distribution of Pain

Pain	Mean ± SD (n=50)	Range	Maximum	Minimum
VAS Pre	6.2 ± 1.4	5	9	4
VAS POST	4.4 ± 1.1	5	7	2

Mean VAS pain score decreased from 6.2 ± 1.4 (pre) to 4.4 ± 1.1 (post), indicating a reduction in pain after intervention.

Diagram 3 Showing the bar diagram distribution of pain

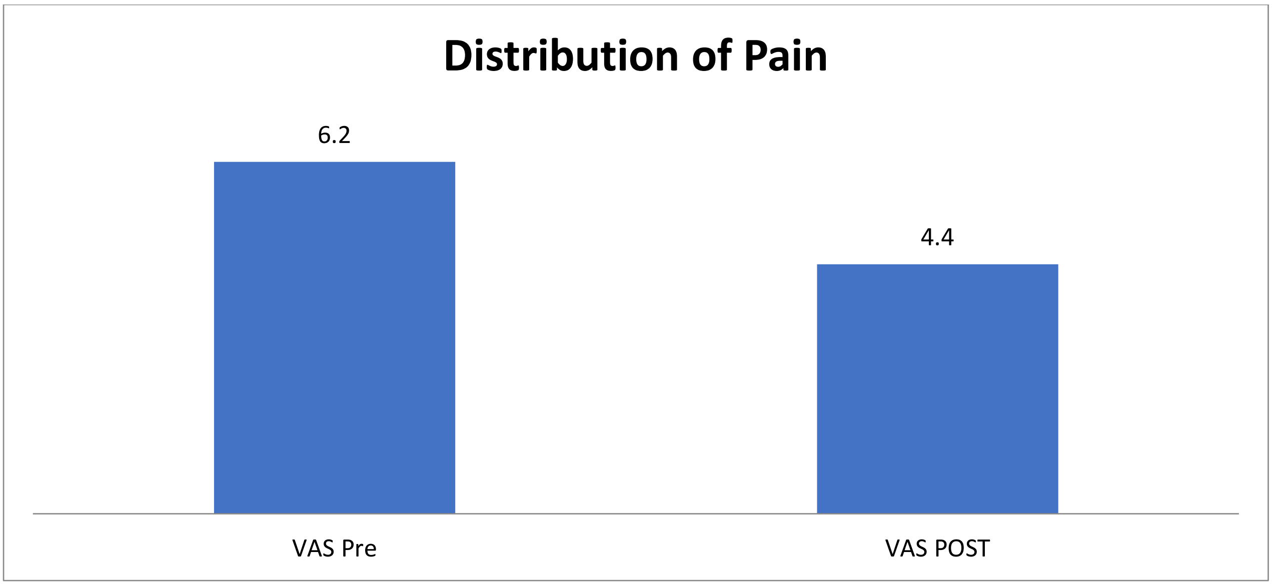

Table 4 Distribution of Disability

Disability	Mean ± SD (n=50)	Range	Maximum	Minimum
NDI Pre	24.08 ± 4.5	20	38	18
NDI POST	16.9 ± 2.5	11	24	13

Mean NDI disability score decreased from **24.08 ± 4.5 (pre)** to **16.9 ± 2.5 (post)**, indicating reduced disability after intervention.

Diagram 4 Showing the bar diagram distribution of disability

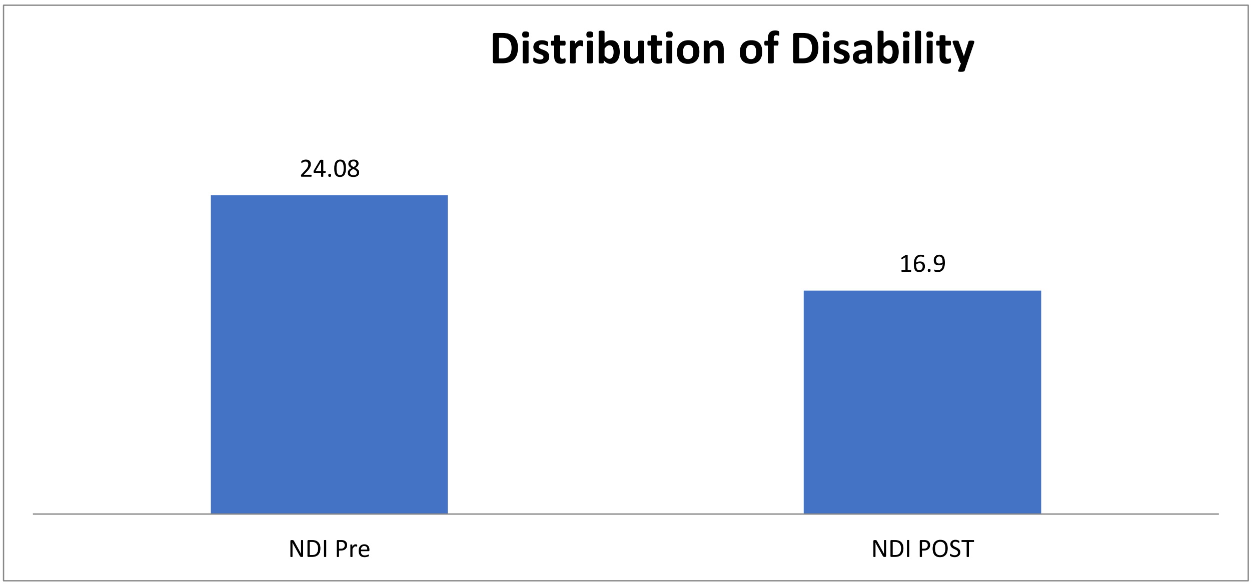

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Table 5 Age-wise Distribution of Patients in Anterior and Posterior

Age	Anterior(n=25)		Posterior (n=25)	
	Number of Patients	Percentage	Number of Patients	Percentage
15-20	2	6.6%	2	8%
20-25	5	20%	4	16%
25-30	6	26.6%	6	24%
30-35	5	23.3%	4	16%
35-40	3	20%	4	16%
40-45	3	3.33%	3	12%
45-50	1	4%	2	8%
Total	25	100%	25	100%

The age distribution in both anterior and posterior is fairly comparable across all categories. The majority of participants in both groups fall within the 25–30 years age range.

Diagram 5 Showing the bar diagram age-wise distribution of patients in anterior and posterior

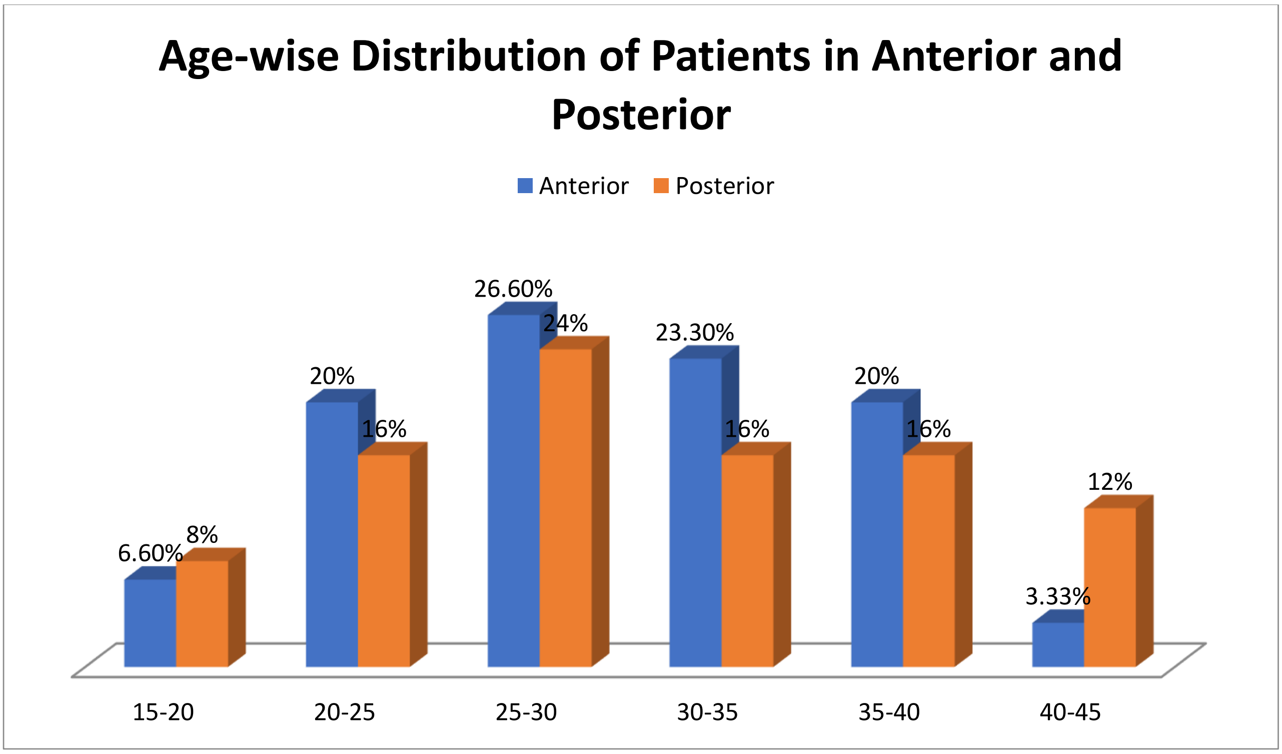

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Table 6 Comparison of Age-wise Distribution between Anterior and Posterior

Age	Anterior(n=25)		Posterior (n=25)		Statistics test value
	Number of Patients	Percentage	Number of Patients	Percentage	
15-20	2	8%	2	8%	$X^2 = 0.6$,P = 0.9,P<0.01(NS)
20-25	5	20%	4	16%	
25-30	6	24%	6	24%	
30-35	5	20%	4	16%	
35-40	3	12%	4	16%	
40-45	3	12%	3	12%	
45-50	1	4%	2	8%	
Total	25	100%	25	100%	

The age distribution between anterior and posterior is comparable, with no significant difference observed ($\chi^2 = 0.6$, p = 0.9).

Table 7 Gender-wise Distribution of Patients in Anterior and Posterior

Gender	Anterior(n=25)		Posterior (n=25)	
	Number of Patients	Percentage	Number of Patients	Percentage
Male	12	48%	13	52%
Female	13	52%	12	48%
Total	25	100%	25	100%

The gender distribution in Anterior and Posterior is fairly similar, with males slightly higher in and equal Anterior distribution in Posterior

Diagram 6 Showing the bar diagram gender wise distribution of patients in Anterior and Posterior

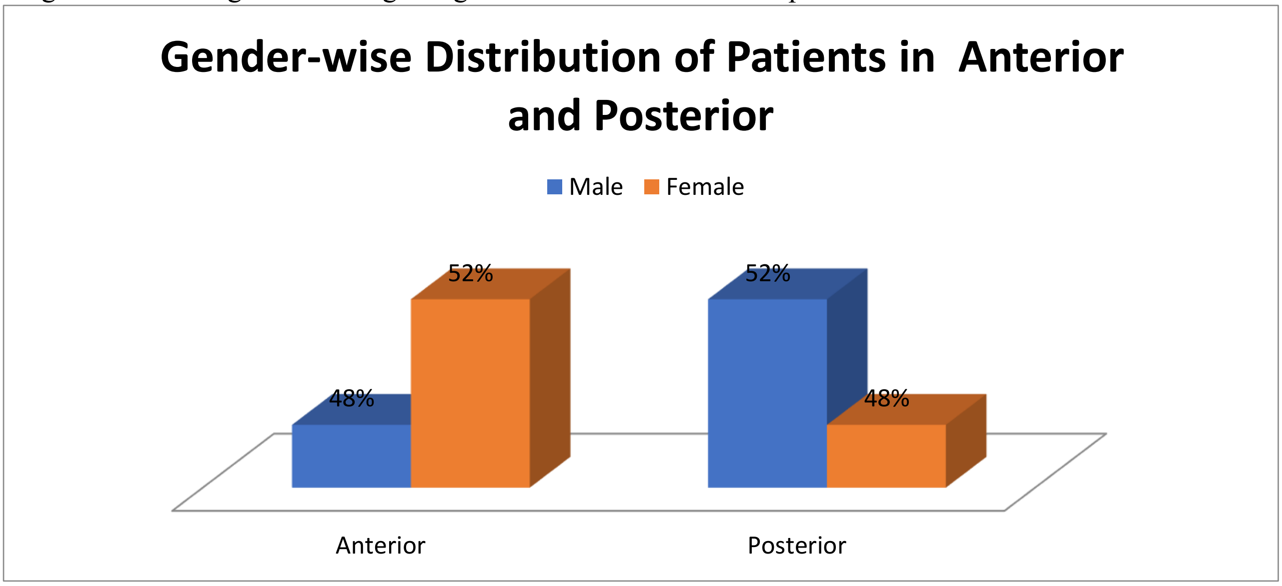

Table 8 Comparison of Age-wise Distribution between Group A and Group B

Gender	Anterior(n=25)	Posterior (n=25)	Statistics test value

	Number of Patients	Percentage	Number of Patients	Percentage	
Male	12	48%	13	52%	X^2 = 0.7,P = 0.08,P<0.01(NS)
Female	13	52%	12	48%	
Total	25	100%	25	100%	

The gender distribution between Anterior and Posterior shows no significant difference (χ^2 = 0.7, p = 0.08,P<0.01 NS).

Table 9 Distribution of VAS Pain Scores in Anterior and Posterior pre and post Intervention

Pain	Anterior(n=25)	Posterior (n=25)
	Mean ± SD(n=30)	Mean ± SD(n=30)
VAS Pre	6 ± 1.4	6.5 ± 1.4
VAS POST	4.6 ± 1.3	4.2 ± 1.03

Both anterior and posterior showed a reduction in VAS pain scores from pre- to post-intervention, indicating improvement in pain.

Diagram 7 Showing the multiple bar diagram Distribution of VAS Pain Scores in anterior and posterior pre and post Intervention

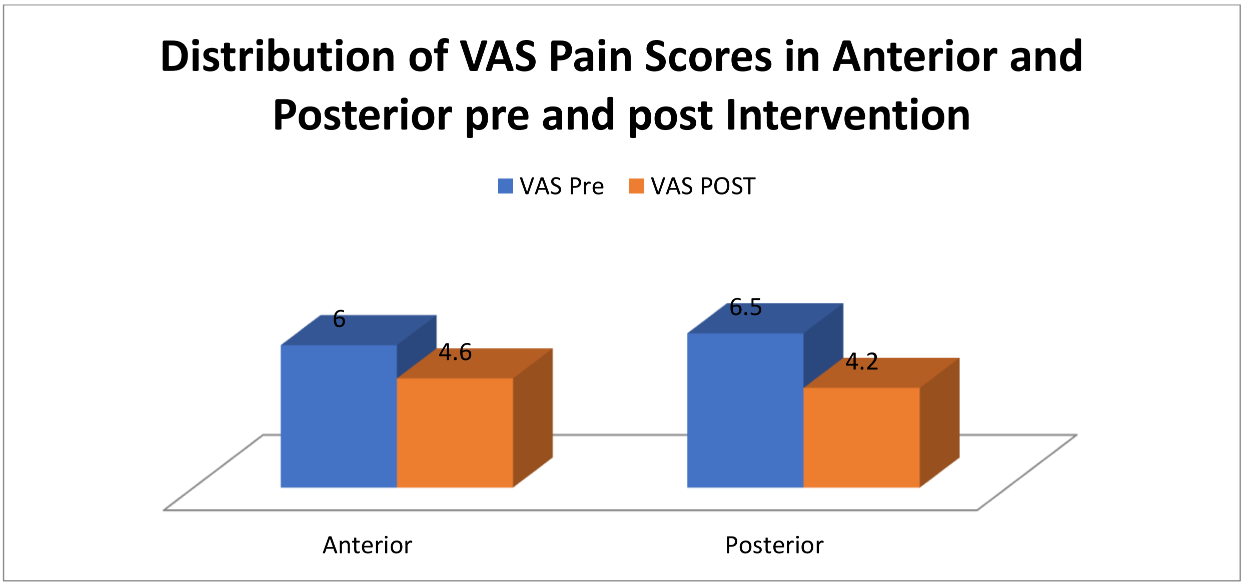

Table 10 Comparison of VAS Pain Scores Between and Within Anterior and Posterior

Pain	Anterior	Posterior	Statistics test value
	Mean ± SD(n=25)	Mean ± SD(n=25)	
VAS Pre	6 ± 1.4	6.5 ± 1.4	t = 1.2,P = 0.2,P<0.01(NS)
VAS POST	4.6 ± 1.3	4.2 ± 1.03	t = 1.2,P = 0.2,P<0.01(NS)
Statistics test value	t = 10.8, P = 0.0001,P<0.001(S)	t = 8.7,P = 0.0001,P<0.001(S)	

Both Anterior and posterior showed a highly statistical significant in VAS pain scores from pre- to post-intervention (P < 0.001). Pre-intervention VAS scores between Anterior and posterior showed no

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significant difference. post intervention VAS scores between Anterior and posterior showed no significant.

Table 11 Distribution of disability NDI in Anterior and Posterior pre and post Intervention

Disability	Anterior	Posterior
	Mean ± SD(n=25)	Mean ± SD(n=25)
NDI Pre	22.9 ± 4.8	25.2 ± 4.1
NDI POST	16.6 ± 3	17.2 ± 1.8

Both anterior and posterior showed a reduction in NDI scores from pre- to post-intervention, indicating improvement in functional disability. anterior demonstrated a greater decrease in disability compared to posterior.

Diagram 8 Showing the multiple bar diagram distribution of disability NDI in Anterior and Posterior pre and post Intervention

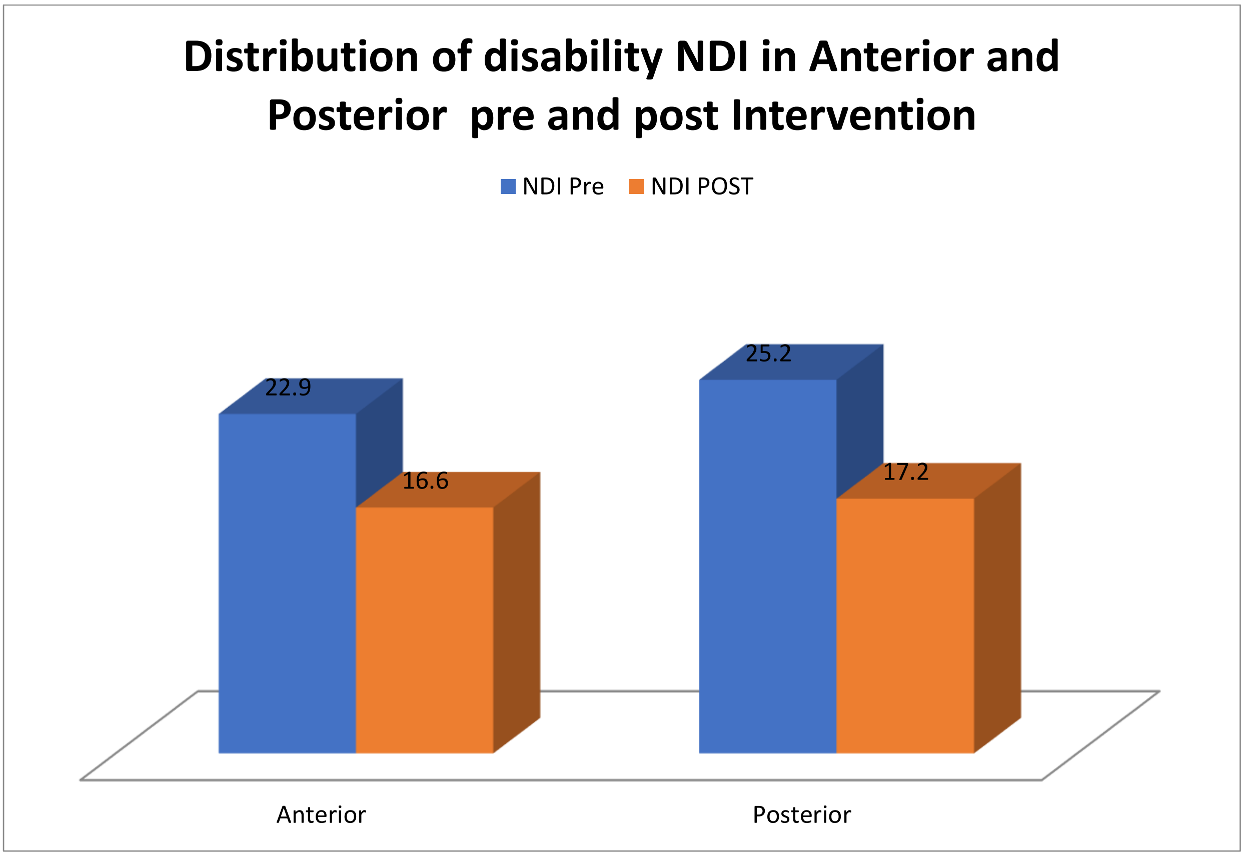

Table12 Comparison of NDI Disability Scores Between Anterior and Posterior

Disability	Anterior	Posterior	Statistics test value
	Mean ± SD(n=30)	Mean ± SD(n=30)	
NDI Pre	22.9 ± 4.8	25.2 ± 4.1	t = 1.8,P = 0.07,P<0.001(NS)
NDI POST	16.6 ± 3	17.2 ± 1.8	t = 0.8,P = 0.3,P<0.001(NS)
Statistics test value	t = 5.5, P= 0.0001,P<0.001(S)	t = 6.1, P = 0.0001,P<0.001(S)	

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Both Anterior and posterior showed a **highly significant reduction in NDI scores** from pre- to post-intervention (Group A: t = 9.5, P = 0.0001; Group B: t = 6.1, P = 0.0001, P<0.0001).

RESULTS

Participant Characteristics

A total of 50 participants were included in the study. The mean age was **30.7 ± 7.8 years**, with an age range of 19–45 years.

The highest proportion of participants was observed in the **25–30 years age group (24%)**, followed by the 20–25 years and 30–35 years groups (18% each). The least represented age group was 45–50 years (6%).

Gender distribution was equal, with **25 males (50%) and 25 females (50%)**, indicating no gender bias in the sample.

Baseline Comparison Between Groups

Age Distribution

There was no statistically significant difference in age distribution between the anterior and posterior groups (**$\chi^2 = 0.6$, p = 0.9**), indicating baseline comparability.

Gender Distribution

Similarly, gender distribution between groups was comparable, with no statistically significant difference observed (**$\chi^2 = 0.7$, p = 0.08**).

Pain Outcomes (VAS)

Within-Group Analysis

Both groups demonstrated a statistically significant reduction in pain following the intervention:

Anterior Group:

Pre-intervention: 6.0 ± 1.4

Post-intervention: 4.6 ± 1.3

$p < 0.001$

Posterior Group:

Pre-intervention: 6.5 ± 1.4

Post-intervention: 4.2 ± 1.03

$p < 0.001$

Between-Group Analysis

There was no statistically significant difference between groups:

Pre-intervention ($p = 0.2$)

Post-intervention ($p = 0.2$)

Functional Disability Outcomes (NDI)

Within-Group Analysis

Both groups showed a statistically significant reduction in disability:

Anterior Group:

Pre-intervention: 22.9 ± 4.8

Post-intervention: 16.6 ± 3.0

$p < 0.001$

Posterior Group:

Pre-intervention: 25.2 ± 4.1

Post-intervention: 17.2 ± 1.8

$p < 0.001$

Between-Group Analysis

No statistically significant difference was observed between groups:

Pre-intervention ($p = 0.07$)

Post-intervention ($p = 0.3$)

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Overall Effect of Intervention

Across all participants, a statistically significant improvement was observed:

VAS scores decreased from **6.2 ± 1.4 to 4.4 ± 1.1**

NDI scores decreased from **24.08 ± 4.5 to 16.9 ± 2.5**

Both reductions were statistically significant ($p < 0.001$).

Summary of Findings

Significant reduction in pain intensity in both groups

Significant improvement in functional disability in both groups

No statistically significant difference between anterior and posterior muscle-focused interventions

DISCUSSION

The present study aimed to evaluate the effectiveness of dry needling combined with isometric exercises on different cervical muscle groups in individuals with non-specific neck pain (NSNP). The findings demonstrated a significant reduction in pain intensity and functional disability in both groups following the intervention. However, no statistically significant difference was observed between the anterior and posterior muscle-focused approaches.

The reduction in pain observed in both groups can be attributed to the physiological effects of dry needling. Dry needling is known to deactivate myofascial trigger points, improve local blood circulation, and modulate pain through both peripheral and central mechanisms. The mechanical stimulation of trigger points may lead to a decrease in nociceptive input and normalization of muscle tone, thereby reducing pain perception.

In addition to dry needling, isometric exercises likely contributed to the observed improvements by enhancing muscle strength, endurance, and neuromuscular control. Isometric contractions stabilize the cervical spine without excessive joint movement, making them particularly effective in individuals with pain. Improved neuromuscular coordination may also help in restoring normal movement patterns and reducing the risk of recurrence.

Both anterior and posterior muscle-focused interventions resulted in comparable outcomes. This finding suggests that cervical muscle groups function as an integrated unit rather than in isolation. The involvement of lateral muscles in both groups may have further contributed to overall cervical stability, thereby minimizing differences between interventions. These results indicate that the effectiveness of treatment depends more on the combination of interventions rather than the specific muscle group targeted.

The significant improvement in Neck Disability Index (NDI) scores further supports the functional benefits of the combined intervention. Reduction in disability reflects not only decreased pain but also improved ability to perform daily activities. This highlights the clinical relevance of incorporating both dry needling and isometric exercises in rehabilitation programs for NSNP.

The findings of this study are consistent with previous literature that supports the effectiveness of dry needling in reducing myofascial pain and the role of isometric exercises in improving cervical stability. However, the present study adds to existing knowledge by demonstrating that targeting different cervical muscle groups does not significantly alter treatment outcomes when both interventions are combined.

Despite the positive findings, certain limitations must be considered. The sample size was relatively small, which may limit the generalizability of the results. The duration of intervention was short, and no long-term follow-up was conducted to assess the sustainability of improvements. Additionally, the absence of a control group makes it difficult to determine the isolated effects of each intervention.

Future research should include larger sample sizes, longer follow-up periods, and the use of objective outcome measures such as range of motion and electromyographic analysis. Comparative studies involving other physiotherapy interventions may also provide further insights into optimal treatment strategies.

CONCLUSION

The present study demonstrates that the combination of dry needling and isometric exercises is effective in reducing pain and improving functional disability in individuals with non-specific neck pain. Significant improvements were observed in both anterior- and posterior-focused cervical muscle groups.

No statistically significant difference was identified between the two approaches, indicating that targeting either anterior or posterior cervical muscles yields comparable outcomes when combined with lateral muscle activation.

These findings suggest that treatment effectiveness is primarily influenced by the combined intervention rather than the specific muscle group targeted. Therefore, clinicians may select either approach based on individual patient needs, clinical presentation, and therapeutic goals.

LIMITATIONS

The present study has several limitations that should be considered while interpreting the findings. The sample size was relatively small, which may limit the generalizability of the results to a broader population. The duration of the intervention was short (2–4 weeks), and no long-term follow-up was conducted to assess the sustainability of treatment effects.

Additionally, the absence of a control group limits the ability to determine the independent effects of dry needling and isometric exercises. The outcome measures used in this study were primarily subjective, including the Visual Analog Scale (VAS) and Neck Disability Index (NDI), which may introduce response bias.

Furthermore, objective outcome measures such as range of motion or electromyographic analysis were not included, which could have provided a more comprehensive evaluation of treatment effectiveness.

FUTURE RECOMMENDATIONS

Future research should focus on conducting studies with larger sample sizes to enhance the generalizability of findings. Long-term follow-up studies are recommended to evaluate the sustainability of treatment effects over time.

Inclusion of a control group would help in determining the independent and combined effects of dry needling and isometric exercises more accurately. Additionally, future studies should incorporate objective outcome measures such as cervical range of motion, muscle strength assessment, and electromyographic analysis to provide a more comprehensive evaluation.

Comparative studies involving different physiotherapy interventions or exercise protocols may further help in identifying the most effective treatment approach for non-specific neck pain. Moreover,

(ISSN: 0973-7049(P))

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stratification of participants based on severity, occupation, or duration of symptoms could offer deeper clinical insights and improve individualized treatment planning.

ETHICAL APPROVAL

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical clearance was obtained from the Institutional Ethics Committee of Pacific Medical College and Hospital, Udaipur. Written informed consent was obtained from all participants prior to their inclusion in the study.

INFORMED CONSENT

All participants were informed about the study procedure, potential risks, and benefits. Written informed consent was obtained before participation.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to this study.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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