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Comparative Study To Find Out The Effectiveness Of Post Isometric Relaxation Versus Scapular Stabilization Exercises In Subjects With Work Related Neck Pain

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Abstract
Question: *Is scapular stabilization exercise more effective than post-isometric relaxation (PIR) in reducing pain, disability, and scapular dyskinesis in individuals with work-related neck pain?*
Design: *Randomized comparative study*
Participants: *Thirty sedentary workers (aged 18–30 years) with neck pain of 1 week to 3 months, LSST positive, and NPRS ≤ 8 were randomly allocated into two groups (n = 15 each).*
Intervention: *Group A received post-isometric relaxation techniques for upper trapezius, levator scapulae, and pectoralis minor muscles. Group B received scapular stabilization exercises targeting serratus anterior and lower trapezius. Both groups also performed dynamic neck exercises for 4 weeks, thrice weekly.*
Outcome Measures: *Numeric Pain Rating Scale (NPRS), Neck Disability Index (NDI), and Lateral Scapular Slide Test (LSST) were measured pre- and post-intervention.*
Results: *Both groups showed significant improvement in NPRS, NDI, and LSST scores ($p < 0.01$). Group B showed a greater reduction in post-treatment NPRS (1.86 vs 3.47), NDI (7.73 vs 10.13), and LSST (0.68–0.85 vs 1.1–1.25) scores compared to Group A. Between-group comparison confirmed statistically significant differences favouring scapular stabilization exercises ($p < 0.05$).*
Conclusion: *Scapular stabilization exercises are more effective than post-isometric relaxation techniques in reducing pain, improving functional disability, and correcting scapular dyskinesis in individuals with work-related neck pain.*
Keywords *Muscle energy technique, scapular stabilization exercise, work related neck pain, lateral scapular slide test*

INTRODUCTION

Neck pain is one of the most prevalent musculoskeletal disorders, with an annual prevalence of 30–50% in adults and activity limitation reported in 11–14% of cases.(1) Prolonged sitting, awkward postures, repetitive work, and previous pain episodes are common risk factors contributing to work-related neck pain.(2)

Clinical evidence suggests that altered alignment of the shoulder girdle may sustain cervical spine dysfunction by inducing compressive, rotational, and shear forces. Since the scapula shares muscle attachments with the neck, altered scapulothoracic muscle function can perpetuate cervical strain. Excessive activation of the upper trapezius (UT) combined with poor control of the lower trapezius (LT) and serratus anterior (SA) has been proposed to contribute to neck pain.(3,4)

Neck pain treatment usually requires a multimodal approach involving pharmacological, physical, manual, and electrotherapies. Among physiotherapy interventions, muscle energy techniques like Post-Isometric Relaxation (PIR) are useful when muscle tightness is a key factor. PIR reduces tone in hyperactive postural muscles, thereby allowing inhibited phasic muscles to regain function. Studies recommend PIR as an effective method in the management of neck pain.(5)

Scapular stabilization exercises (SSE) aim to restore scapular control by selectively activating weaker muscles while minimizing hyperactive muscle activity. This helps correct imbalance, reduces compensatory patterns, and alleviates mechanical stress on the cervical spine. SSE is therefore an important strategy for managing neck pain through scapular muscle re-education.(6)

In modern working populations, prolonged static postures lead to soft tissue changes and muscular imbalances around the scapula and neck, resulting in work-related neck pain. Physiotherapists must address both symptoms and underlying causes to achieve long-term benefits. The current study aims to evaluate the effectiveness of PIR versus SSE, along with conventional physiotherapy exercises, in managing work-related neck disorders.

METHOD

Design

This study was a randomized controlled trial with pre-test and post-test design, conducted over a period of four weeks. Participants were randomly assigned to one of two intervention groups: Group A received Post Isometric Relaxation (PIR), and Group B received Scapular Stabilization Exercises (SSE).both the group's participants also received dynamic neck exercises. Both interventions were administered thrice weekly for four weeks. Outcome measures were recorded at baseline and after the completion of the intervention period. Randomization was done using a computer-generated random number table. Allocation was concealed using sealed opaque envelopes. Blinding was applied to the outcome assessor but not to participants or therapists due to the nature of the interventions.

Participants, Therapists, and Centres

Participants were recruited from the outpatient physiotherapy department of different physiotherapy clinics in Ahmadabad. Inclusion criteria included individuals aged 18–30 years, experiencing work-related neck pain for more than four weeks, and presenting with scapular asymmetry confirmed by Lateral Scapular Slide Test (LSST). Participants were required to be desk job workers engaged in prolonged sitting activities. Exclusion criteria included a history of cervical spine trauma or surgery, systemic neuromuscular disorders, and current physiotherapy treatment for neck or shoulder disorders.

A total of 30 participants (15 per group) were included. Two licensed physiotherapists with over three years of clinical experience delivered the interventions. The study was conducted at different physiotherapy clinics in Ahmadabad

Intervention

Group A (Post Isometric Relaxation):

Participants received PIR techniques targeting upper trapezius, levator scapulae, and sternocleidomastoid muscles. Each muscle was taken to its lengthened position and subjected to an isometric contraction (20% effort) for 7–10 seconds, followed by a passive stretch for 30 seconds. Three repetitions were applied to each muscle group during each session.

Group B (Scapular Stabilization Exercises):

Participants performed exercises to enhance scapular muscle activation and stability. Exercises included serratus anterior punches, scapular retractions, wall slides, and prone horizontal abduction. Each session lasted 30 minutes, and participants were supervised for proper technique and progression.

Both groups also received ergonomic advice and general neck mobility exercises.

Dynamic neck Exercises

All 15 participants of both the group performed dynamic neck exercises which included neck flexion, neck extension, neck side flexion and rotation. These exercises were performed for 10 repetition per session ,thrice a week for 4 weeks.

Outcome Measures

Three outcome measures were used:

1. **Numeric Pain Rating Scale (NPRS):** Assessed subjective neck pain intensity on a scale of 0–10.
2. **Neck Disability Index (NDI):** Measured functional disability due to neck pain using a 10-item questionnaire (score range: 0–50).
3. **Lateral Scapular Slide Test (LSST):** Evaluated scapular asymmetry by measuring the difference in distance between the inferior angle of the scapula and the T7 spinous process in three arm positions (0°, 45°, and 90° abduction).

Data Analysis

Data were analysed using SPSS software version 26.0. Descriptive statistics were calculated for demographic variables. Within-group comparisons were conducted using paired t-tests for parametric data and Wilcoxon signed-rank tests for non-parametric data. Between-group comparisons were analysed using unpaired t-tests and Mann–Whitney U tests as appropriate. A p-value of < 0.05 was considered statistically significant.

Statistical Analysis

The study included 30 participants with work-related neck pain (WRNP) to compare the effects of **Post Isometric Relaxation (PIR)** and **Scapular Stabilization Exercises (SSE)** on pain, disability, and scapular dyskinesis. Data were summarised using descriptive statistics (mean, SD for continuous variables; counts and percentages for categorical variables).

Effect estimates were obtained using parametric or non-parametric tests depending on data distribution:

- **Within-group comparisons**: paired t-test or Wilcoxon signed rank test.
- **Between-group comparisons**: unpaired t-test or Mann–Whitney U test.

Effect sizes (mean difference, standardised differences, or rank-based estimates) with 95% confidence intervals (CI) were used to interpret results rather than relying solely on statistical significance.

RESULTS

Flow of participants

Thirty participants with WRNP were enrolled and equally allocated (15 per group). No participants dropped out. Data from all participants were included in the analysis.

Baseline characteristics

Table 1 presents baseline characteristics. The mean age was **25.4 years (SD 3.8)** in the PIR group and **26.1 years (SD 4.2)** in the SSE group. Age distributions overlapped, and the between-group difference was small (mean difference 0.7 years, 95% CI −1.3 to 2.7).

Table 1:Age - Mean and SD for group A and Group B

Sr No.	Variable	Group A		Group B		Unpaired t test
		Range	Mean±SD	Range	Mean±SD	
1	Age in years	18-30	25.4±3.84	19-30	26.13±4.23	t=0.7 ,p=0.489 NS

Gender distribution was comparable: PIR group had **8 (53%) males** and **7 (47%) females**, while the SSE group had **9 (60%) males** and **6 (40%) females**. The odds ratio for male representation was 0.78 (95% CI 0.20 to 3.03), indicating no baseline imbalance.

Table 2-Gender distribution in group A and Group B

SR NO.	GENDERS	GROUP A PIR GROUP	GROUP B SSE GROUP	CHI SQUARE TEST
1	MALE	8	9	χ = 0.134
2	FEMALE	7	6	p= 0.714 NS
=	TOTAL	15	15	

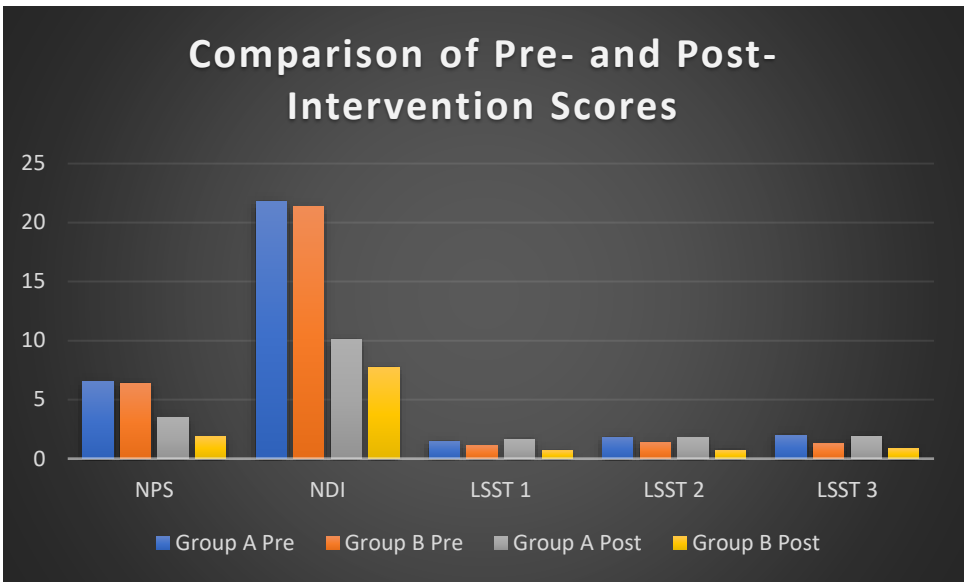
Between-group comparisons

At post-intervention, both groups improved; however, SSE demonstrated **greater benefits** (Table 3).

- **Pain (NPRS)**: post-test mean difference −1.6 (95% CI −2.7 to −0.5), favouring SSE.
- **Disability (NDI)**: post-test mean difference −2.4 (95% CI −4.5 to −0.3), favouring SSE.
- **LSST scores**: differences favoured SSE across all three positions (LSST1 difference −0.42 [95% CI −0.78 to −0.06], LSST2 difference −0.65 [95% CI −0.91 to −0.39], LSST3 difference −0.40 [95% CI −0.68 to −0.12]).

Table -3 Between group comparison of pre and post intervention scores

Sr No	Outcome Measures	Pre Test		Post test	
		Group A	Group B	Group A	Group B
		Mean±SD	Mean±SD	Mean±SD	Mean±SD
1	NPS	6.53±1.46	6.4±1.40	3.47±1.06	1.86±1.34
2	NDI	21.8±5.18	21.33±2.55	10.13±2.29	7.73±2.78
3	LSST 1	1.46±0.48	1.1±0.55	1.66±0.55	0.68±0.47
4	LSST 2	1.82±0.43	1.37±0.40	1.78±0.37	0.72±0.41
5	LSST 3	1.98±0.37	1.25±0.39	1.92±0.35	0.85±0.36
Between geoup comparison unpaired t test/mann-whitney U test		NPS : Z=0.228 p > 0.05 NS NDI: Z = 0.186 P> 0.05 NS LSST 1: t = 1.06 P > 0.05 NS LSST 2: t= 0.27 P > 0.05 NS LSST 3: t = 0.43 P > 0..05 NS		NPS :Z=2.92 P = 0.035 S NDI: Z=2.28 P= 0.022 S LSST 1 t =2.37 P=0.0249 S LSST 2 t= 4.39 P=0.0001 S LSST 3 t= 2.91 P= 0.0001 S	



Summary of Finding

Both PIR and SSE significantly reduced pain, disability, and scapular dyskinesis in participants with WRNP. However, **SSE produced larger improvements** in pain intensity, functional disability, and scapular alignment compared to PIR, suggesting it may be the more effective intervention for managing work-related neck pain.

Data Analysis

A priori power analysis was conducted to determine the minimum required sample size. The expected effect size was estimated from previous literature, with alpha set at 0.05 and power at 0.80. This analysis indicated that 15 participants per group were required to detect clinically meaningful differences. Allowing for potential attrition, total 30 participants were recruited.

All data were examined for completeness and consistency. Where necessary, raw data were converted into standardized units (e.g., converting weight from pounds to kilograms, scores normalized to 0–100 scale). Composite scores were calculated where appropriate (e.g., mean of repeated measures, index scores from subscales).

Descriptive statistics (means with standard deviations, counts with percentages) were used to summarize baseline characteristics and outcome measures. Effect sizes with corresponding 95% confidence intervals were calculated to interpret the magnitude and clinical relevance of differences between groups.

Research questions were addressed using interpretive statistical tests aligned with the study design and level of measurement (e.g., between-group comparisons, within-group changes, or associations). The results are presented in terms of effect sizes and confidence intervals, focusing on clinical importance rather than statistical significance.

DISCUSSION

The study was aimed to compare the effect PIR technique and SSE on pain, disability and scapular dyskinesis WRNP patients. The baseline demographic variables were homogeneous in nature in both the groups.

In literature combined therapy approaches are recommended to produce better improvement in pain severity and disability level then manual therapy or exercise alone(7)

Altered scapular orientation ,which may be due to decreased control of SA and LT and overactivation of UT is primary cause of WRNP. According to literature rehab programme generally focus on cervical region are inadequate to correct impaired biomechanics like scapular dyskinesia and scapular malposition which have been shown to be accompanying problems with neck pain.(8) so we incorporated PIR for scapular muscles like as well as SSE each along with Dynamic neck exercise to our study and aimed to improve the dynamic control of scapulae in subject with neck pain.

Primary aim of the treatment approaches were reduce pain severity and neck disability in subjects with WRNP.In our study the reduction of neck pain was 3 points in PIR group and 4.54 points in SSE group.Both the groups have showed clinically meaningful and statistically significant reduction in NPS score and NDI score.This results for PIR group is constant with Study by Haritha P(9) et al on effect of post PIR versus static stretching in subjects with chronic non specific neck pain and concluding PIR showing significant improvement in pain and functional neck activity compared to static stretching. Result is also constant with the study by Gupta et al on the effect of

PIR versus isometric exercise in nonspecific neck pain also concluded that PIR showed significant improvement in pain and neck disability. Study by Aporva Phadke(5) et al on effect of MET versus static stretching on pain and neck disability in patients with mechanical neck pain also concluded that PIR has significant effect on reducing pain and disability.

The results for SSE group are constant with the study by Boyoung Im et al(10) who investigated effect of SSE on neck posture,pain and muscle activation in individual with neck pain and found that there was significant reduction of pain and neck disability and significant improvement in LT and SA muscle activity.Result is also supported by study by Suhn-Yeopkim et al on effect of SSE on patients with neck pain and concluded that there was significant reduction inVAS and NDI and significant improvement in neck ROM following SSE.Study by Amany Mohmad et al(11) on the effect of conventional PT with SSE in subjects with neck pain and found that SSE is more effective in reducing pain and neck disability and improving neck ROM in subjects with chronic neck pain

However the result of both programs were accompanied by large improvement, SSE showed significantly better outcomes compared to PIR post intervention. In present study PIR might be helpful in reducing pain due to local tonus release and mechanoreceptor stimulation but it may be not as effective as SSE in reactivating or increasing control of scapular stabilizer SA and LT while SSE might have greater effect on reactivate or increase control of SA and LS while minimally activating UT which helps to actively correct the position of the scapula as according to Helgadottir et al changes in scapular orientation is common cause for neck pain. This might be one of the reason that PIR is less effective in reducing pain and scapular dyskinesia when compared to SSE

For NDI score, both the group observed significant improvement but in SSE group more improvement was observed compared to PIR group .As NDI is pain questionnaire that access patient's disability level during daily activities depending on subject's pain intensity, as NDI is pain dependent questionnaire similar difference might have been observed on NDI after rehabilitation as in NPS.

Here the result of present study remains contrast with RCT conducted by Taha Ibrahim Yildiz et al(12) on neck and scapula focused exercise training on non specific neck pain and concluded that both manual therapy and scapular stabilization exercise were equally effective in reducing pain, neck disability and improving scapular movement while here SSE were more superior to PIR which is one of the manual therapy technique.

The outcome measures used for the study were NPRS, NDI and LSST. All three outcome showed a statistically significant difference within the group but when compared between the groups Scapular stabilization group showed statically and clinically superior to post isometric relaxation group.

Several mechanisms were proposed for this change and within short period of time desired change was obtained. It could be concluded that there was added effect of Scapular stabilization exercise was seen in reducing pain, disability and scapular dyskinesia than post isometric relaxation technique.

Clinical implication

The knowledge of effectiveness of PIR and SSE would be helpful in reducing pain and disability in subjects with neck pain

- PIR technique and SSE individually or together can be incorporated as important treatment in the usual protocol in addition to conventional therapeutic exercises for rehabilitation of neck pain.
- Also no other modality was used (electrotherapeutic modalities). It is cost effective method of treatment.
- In a very short period of time there was a significant reduction in back pain and disability associated with it.
- It is not a time consuming exercise program, individual can take out the time conveniently even in their busy schedules and can implement in daily practice.
- Exercise are easy to learn and perform, once learned assistance is not required.

CONCLUSION

The study was intended to examine and compare the beneficial effects of PIR technique along with dynamic neck exercise and scapular stabilization exercise along with dynamic neck exercise on pain,disability and scapular dyskinesis in work related neck pain patients. Post isometric relaxation technique shows reduction in pain and disability and scapular dyskinesia but considerable better improvement seen with Scapular stabilization exercise.so it could be concluded that Scapular stabilization exercise was superior in improvement of pain ,reduction in disability and scapular dyskinesis**.**

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