

Article

Comparison of V-Sitting Posture Stabilization and Modified Clamshell Exercises on Pain and Disability in Non-Specific Chronic Low Back Pain

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ABSTRACT

Background: Non-specific chronic low back pain (NSCLBP) is a leading global cause of disability, often managed through exercise-based rehabilitation; however, limited comparative evidence exists regarding the effectiveness of core versus hip-focused interventions. **Objective:** To compare the effects of V-Sitting Posture Stabilization and Modified Clamshell Exercises on pain intensity and functional disability in individuals with NSCLBP. **Methods:** This single-blinded randomized controlled trial included 30 participants (n = 26 analyzed) aged 20–50 years with NSCLBP for over three months. Participants were randomly assigned to receive either V-Sitting Posture Stabilization or Modified Clamshell Exercises for six weeks. Standard stretching and physiotherapy modalities were applied across both groups. Pain was assessed using the Numeric Pain Rating Scale (NPRS), and functional disability was evaluated using the Roland Morris Disability Questionnaire (RMDQ). Ethical approval was obtained from the Riphah International University Institutional Review Board (REC/RCR & AHS/22/0104) in accordance with the Declaration of Helsinki. Statistical analysis was conducted using SPSS v25; paired and independent t-tests were used with significance set at $p < 0.05$. **Results:** Both groups showed significant within-group improvements in NPRS (Group A: 6.47, Group B: 4.87; $p = 0.00$) and RMDQ (Group A: 16.67, Group B: 12.87; $p = 0.00$). The V-Sitting group demonstrated superior post-intervention RMDQ scores ($p = 0.025$), with a clinically meaningful 3.8-point difference, and a favorable NPRS trend ($p = 0.069$). **Conclusion:** V-Sitting Postural Stabilization was more effective than Modified Clamshell Exercises in improving disability and showed clinically significant advantages in pain reduction, suggesting its potential as a preferred intervention for NSCLBP in clinical settings. **Keywords:** Low Back Pain, Core Stability, Postural Exercise, Chronic Pain, Functional Disability, V-Sitting Position, Rehabilitation Therapy.

INTRODUCTION

Non-specific chronic low back pain (NSCLBP) remains one of the most prevalent musculoskeletal (MSK) disorders globally, affecting approximately 65% of individuals with chronic MSK pain syndromes and contributing significantly to disability and reduced quality of life (1,2). As a leading cause of disability and lost productivity, low back pain (LBP) affects up to 84% of the adult population during their lifetime (3). The majority of LBP cases are considered non-specific, indicating the absence of an identifiable pathoanatomic cause (4). Clinically, LBP is categorized based on duration into acute (1–4 weeks), subacute (4–12 weeks), and chronic (more than 12 weeks) phases, with chronic cases requiring a multidimensional management approach (5). Epidemiological data demonstrate that individuals with prior LBP episodes are at elevated risk of recurrence, underlining the importance of

sustainable intervention strategies (6). Current recommendations for LBP management include a blend of pharmacological options—such as NSAIDs, acetaminophen, and muscle relaxants—and non-pharmacologic treatments, including physical therapy, manual techniques, and structured exercise programs (7,8).

The literature continues to underscore the efficacy of rehabilitative therapies and exercise-based interventions as first-line treatments for NSCLBP (9,10). Among these, core stabilization and hip strengthening exercises have gained considerable attention due to their role in enhancing neuromuscular control and improving lumbopelvic stability (11). V-Sitting Posture Stabilization exercises and Modified Clamshell exercises represent emerging modalities aimed at addressing core dysfunctions often implicated in NSCLBP. V-Sitting exercises primarily engage trunk

flexors and extensors, along with the diaphragm and pelvic floor, enhancing spinal stabilization via isometric contractions in an unstable seated position (12). This form of training not only strengthens the core but also facilitates improved proprioception and motor control. Conversely, the Modified Clamshell exercise, often implemented in a side-lying position, targets the gluteus medius and other hip abductors. These muscles are critical for pelvic alignment and load transfer across the lumbopelvic region during functional activities (13).

Despite the recognized importance of both core and hip musculature in managing NSCLBP, existing literature has rarely compared these two specific interventions—V-Sitting Posture Stabilization and Modified Clamshell exercises—in a controlled setting. While studies have individually supported each modality's benefits in reducing pain and improving function, the comparative effectiveness remains largely unexplored. Furthermore, existing evidence often lacks rigorous trial designs or fails to contextualize findings within clinically meaningful parameters such as minimum detectable change or minimal clinically important differences on scales like the NPRS and RMDQ (18,19). This creates a notable gap in evidence-based guidance for clinicians seeking the most effective therapeutic exercise protocol for NSCLBP.

The current randomized clinical trial was conceived to address this gap by systematically comparing the effects of V-Sitting Posture Stabilization and Modified Clamshell exercises on pain intensity and functional disability among patients with NSCLBP. Conducted under stringent ethical guidelines and using validated outcome measures, this study aims to contribute to a more nuanced understanding of exercise-based rehabilitation for chronic back pain. The central research question guiding this study is: *Do V-Sitting Posture Stabilization exercises result in greater reductions in pain and disability compared to Modified Clamshell exercises in individuals with non-specific chronic low back pain?*

MATERIAL AND METHODS

This randomized controlled trial was conducted to evaluate the comparative effectiveness of V-Sitting Posture Stabilization and Modified Clamshell Exercises on pain and disability in individuals with non-specific chronic low back pain (NSCLBP). The study was carried out at the Riphah Rehabilitation Clinic, Quaid-e-Azam Campus, Lahore, Pakistan. Ethical approval for the study was obtained from the Institutional Review Committee of Riphah International University, Islamabad (Lahore Campus) under reference number REC/RCR & AHS/22/0104. The study adhered to the ethical principles outlined in the Declaration of Helsinki. All participants provided written informed consent before enrollment, and confidentiality of the participants' personal and medical information was strictly maintained throughout the study.

Participants were recruited using a convenience sampling method from the outpatient population of the rehabilitation clinic. A total of 40 individuals initially underwent eligibility screening. The inclusion criteria were: adults aged between 20 and 50 years, diagnosed with NSCLBP persisting for more than three months, and a negative result on the straight leg raise test. Individuals were excluded if they had metabolic bone disorders such as osteoporosis or osteopenia, systemic diseases including rheumatoid arthritis, spinal cord injuries, vertebral fractures, or

clinical signs of radiculopathy. Of the 40 screened, 10 participants were excluded due to non-eligibility or refusal to participate, resulting in a final sample of 30 individuals. Participants were randomized into two equal groups of 15 using a lottery method. Randomization was executed by having participants draw sealed envelopes marked 'A' or 'B', which corresponded to the two intervention groups. The study followed a single-blinded design in which the outcome assessor remained unaware of the group allocation.

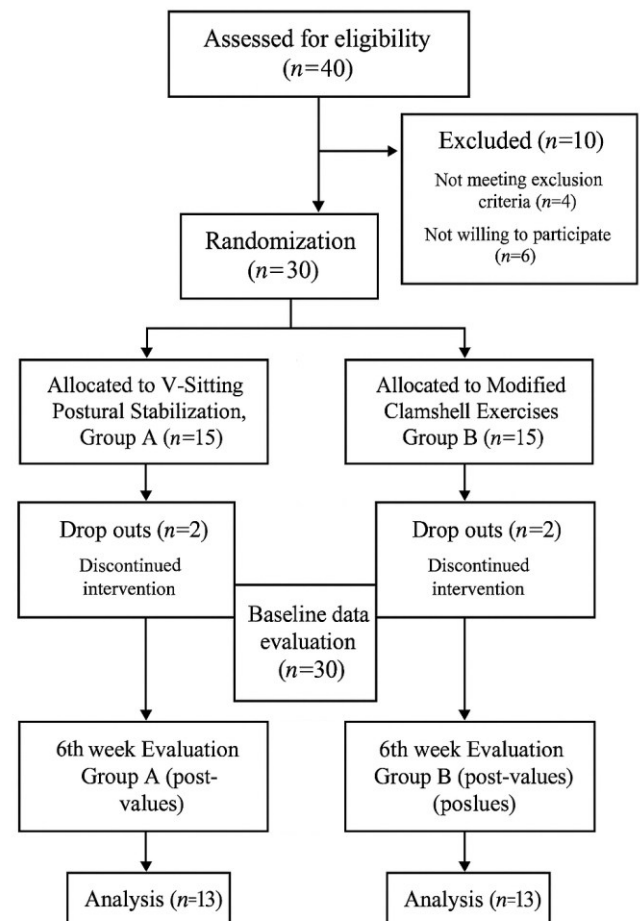


Figure 1 CONSORT Flowchart

Participants in Group A performed the V-Sitting Posture Stabilization exercise regimen. This exercise involved seating on a plinth with the hands and feet placed in support, followed by progressive contraction of the abdominal and core muscles while raising both legs at a 45-degree angle and lifting the torso with a slight 30% flexion in the arms. The posture was held for 10 seconds and participants were instructed to engage in deep breathing throughout the movement. The protocol was initiated with five repetitions and progressed to 15 repetitions over the six-week intervention period. A heat pack and Transcutaneous Electrical Nerve Stimulation (TENS) were applied as part of a standard warm-up routine prior to exercises.

Group B participants engaged in the Modified Clamshell Exercise. In a side-lying position with hips flexed at 45° and knees at 90°, the participants performed the exercise by abducting the top knee while keeping the feet together, thereby engaging the gluteus

medius. A wall was used for feedback to ensure correct posture and alignment. A stabilizer pressure biofeedback device, consisting of an inflatable airbag and a pressure gauge, was placed between the lower ribs and the iliac crest to monitor pelvic stability. The device was inflated to 40 mmHg and participants were required to maintain the pressure between 35 and 45 mmHg throughout the exercise. As in Group A, the session began with five repetitions and was progressed to 15 repetitions. Heat pack and TENS were similarly applied prior to exercises in Group B.

In both groups, standard static stretching routines were provided as adjunct therapy. These included hamstring stretches performed with the participant reaching toward their toes while in a long-sitting position until a moderate discomfort threshold was reached, held for 10 to 30 seconds for two to four repetitions. Gluteal stretching was performed by crossing one leg over the other and gently pulling the contralateral leg towards the chest, held for similar durations and repetitions. Static iliopsoas stretching was carried out in the prone position with the therapist applying a low-intensity stretch on the affected side by stabilizing the pelvis and elevating the leg.

Outcome measures were assessed at baseline and at the end of the six-week intervention. The primary outcome was pain intensity, measured using the Numeric Pain Rating Scale (NPRS), a validated 11-point scale with excellent test-retest reliability (ICC = 0.95) and strong construct validity ($r = 0.941$) (18). The secondary outcome was functional disability, assessed using the Roland Morris Disability Questionnaire (RMDQ), a self-reported measure with established validity ($r = 0.72$) and reliability (ICC = 0.93) in low back pain populations (19). These assessments were carried out by a blinded evaluator at baseline and post-intervention.

Statistical analyses were conducted using SPSS version 25. The Shapiro-Wilk test was employed to assess normality of the data.

Within-group comparisons (pre- and post-treatment) were performed using paired sample t-tests, while between-group differences were analyzed using independent sample t-tests. Statistical significance was set at $p < 0.05$. Data were analyzed based on available cases, and no imputation was applied for missing data as the final dataset included complete records for 26 participants who completed the intervention. Confounding variables were minimized through randomization, and participant characteristics were compared at baseline to confirm group homogeneity.

RESULTS

A total of 40 participants were screened for eligibility in this randomized controlled trial. Ten individuals were excluded—4 did not meet the inclusion criteria and 6 declined to participate. The remaining 30 participants were randomized into two equal groups: 15 participants were assigned to the V-Sitting Postural Stabilization group (Group A), and 15 were assigned to the Modified Clamshell Exercise group (Group B). During the intervention period, 2 participants from each group discontinued the intervention due to personal reasons, resulting in 13 participants per group ($n = 26$) completing the study and being included in the final analysis.

The demographic characteristics of the participants in both groups were statistically comparable at baseline, indicating successful randomization and group equivalence. The mean age was 39.80 ± 6.53 years in Group A and 41.06 ± 6.54 years in Group B ($p = 0.600$). The average body weight was 51.93 ± 8.59 kg in Group A and 52.66 ± 5.30 kg in Group B ($p = 0.781$). Heights were 1.62 ± 0.06 m and 1.63 ± 0.04 m respectively ($p = 0.775$), and body mass index (BMI) was 19.71 ± 3.50 kg/m² in Group A versus 19.86 ± 2.68 kg/m² in Group B ($p = 0.890$), confirming no statistically significant differences across all baseline parameters.

Table 1. Baseline Demographic Characteristics of Study Participants ($n = 26$)

Variable	Group A: V-Sitting Posture Stabilization ($n = 13$)	Group B: Modified Clamshell Exercise ($n = 13$)	p-value
Age (years)	39.80 ± 6.53	41.06 ± 6.54	0.600
Weight (kg)	51.93 ± 8.59	52.66 ± 5.30	0.781
Height (m)	1.62 ± 0.06	1.63 ± 0.04	0.775
BMI (kg/m ²)	19.71 ± 3.50	19.86 ± 2.68	0.890

At baseline, the mean pain score on the Numeric Pain Rating Scale (NPRS) was 8.53 ± 0.63 in Group A and 8.93 ± 0.70 in Group B ($p = 0.115$), showing no significant difference between groups. After six weeks of intervention, Group A exhibited a substantial reduction in pain with a post-intervention mean of 2.06 ± 1.57 , compared to 4.06 ± 1.79 in Group B. The within-group reduction in NPRS was statistically significant in both groups (Group A: $p = 0.00$; Group B: $p = 0.00$). The mean change (pre-post) in pain scores was 6.47 points in Group A and 4.87 points in Group B. Although the between-group post-intervention comparison showed a trend favoring Group A, the result was not statistically significant ($p = 0.069$). Clinically, the observed difference of 2 points in NPRS exceeds the minimal clinically important difference (MCID), suggesting a meaningful benefit from the V-Sitting intervention.

Functional disability, assessed using the Roland Morris Disability Questionnaire (RMDQ), also showed statistically and clinically significant improvements in both groups. Baseline RMDQ scores were 21.20 ± 2.56 for Group A and 21.27 ± 2.11 for Group B ($p = 1.000$). Following six weeks of treatment, Group A demonstrated a substantial reduction to 4.53 ± 3.97 , while Group B decreased to 8.33 ± 4.77 . The within-group changes were highly significant in both groups (Group A: $p = 0.00$; Group B: $p = 0.00$), with mean improvements of 16.67 and 12.87 points respectively. The between-group post-intervention comparison revealed a statistically significant advantage for Group A with a mean difference of -3.8 points ($p = 0.025$), surpassing the threshold for clinically meaningful improvement in disability scores.

Both intervention protocols—V-Sitting Posture Stabilization and Modified Clamshell Exercises—were effective in significantly

reducing pain intensity and functional disability in patients with non-specific chronic low back pain. Group A (V-Sitting) achieved greater improvements in both domains. The reduction of 6.47

points in pain and 16.67 points in disability for Group A represents large effect magnitudes, suggesting not only statistical but also robust clinical relevance.

Table 2. Pre- and Post-Intervention Comparisons of Pain (NPRS) and Disability (RMDQ) Scores

Outcome Measure	Time Point	Group A: V-Sitting (Mean \pm SD)	Group B: Clamshell (Mean \pm SD)	Mean Difference (Group A vs B)	p-value
NPRS	Pre	8.53 \pm 0.63	8.93 \pm 0.70	-0.40	0.115
	Post	2.06 \pm 1.57	4.06 \pm 1.79	-2.00	0.069
	Change	6.47	4.87	—	0.00
RMDQ	Pre	21.20 \pm 2.56	21.27 \pm 2.11	-0.07	1.000
	Post	4.53 \pm 3.97	8.33 \pm 4.77	-3.80	0.025
	Change	16.67	12.87	—	0.00

The between-group superiority in RMDQ scores ($p = 0.025$) further underscores the enhanced functional benefit of the V-Sitting protocol. Although the difference in pain reduction between groups was not statistically significant ($p = 0.069$), it was clinically meaningful, indicating that V-Sitting Postural Stabilization may offer superior outcomes over the Modified Clamshell approach when prioritizing patient-centered clinical metrics.

DISCUSSION

The present randomized controlled trial investigated the comparative effects of V-Sitting Postural Stabilization and Modified Clamshell Exercises on pain and disability in patients with non-specific chronic low back pain (NSCLBP), a condition with significant global prevalence and socioeconomic burden. The findings demonstrated statistically and clinically significant improvements in both groups across pain intensity and functional disability measures. However, the V-Sitting group exhibited greater reductions in both domains, suggesting enhanced therapeutic potential. The reduction in NPRS score by 6.47 points and RMDQ by 16.67 points in the V-Sitting group surpassed minimal clinically important differences and thus indicate substantial clinical relevance, particularly when compared to the Modified Clamshell group, which showed improvements of 4.87 and 12.87 points, respectively.

These results align with existing literature advocating core stabilization as a primary strategy for managing chronic low back pain. Previous studies have underscored the value of dynamic core stabilization exercises in improving lumbar stability and reducing disability (1, 10, 27). Specifically, Ojoawo *et al.* demonstrated the superiority of V-Sitting over bridging exercises in reducing NPRS scores in NSCLBP, echoing the trend observed in this trial where the V-Sitting group showed a greater effect size in pain reduction (10). This is likely attributed to the biomechanical advantage of V-Sitting exercises, which involve simultaneous engagement of the abdominal, paraspinal, and pelvic floor musculature. These muscle groups collectively enhance spinal segmental control and neuromuscular responsiveness, thereby modulating pain pathways and improving function (11, 12).

In contrast, the Modified Clamshell Exercise primarily targets the gluteus medius and other hip abductors, which are essential for pelvic alignment and lumbopelvic load transmission. Although several studies support the role of gluteal strengthening in

reducing back pain (13, 26), the current findings suggest that isolated strengthening of hip muscles may be less impactful than global core engagement strategies. Notably, Olawale *et al.* demonstrated significant benefits of Clamshell-based gluteus medius strengthening on disability and pain; however, their findings did not establish superiority over core stabilization interventions (26). This trial adds to that discourse by directly comparing these modalities and confirming the more robust outcomes of a comprehensive core-focused approach.

Mechanistically, the rhythmic co-contraction of diaphragm, pelvic floor, and trunk muscles during V-Sitting enhances intra-abdominal pressure and lumbar stiffness, which may contribute to the observed reduction in pain and functional limitations (12). Additionally, the neuromuscular challenge posed by the unstable seated posture in V-Sitting may promote cortical reorganization and proprioceptive adaptation, factors increasingly recognized in chronic pain rehabilitation. The Modified Clamshell, while effective in motor recruitment of key hip stabilizers, may lack sufficient stimulus to induce the systemic neuromotor benefits required for broader disability reduction.

This study offers a methodologically rigorous comparison of two evidence-based interventions using validated outcome tools, including the NPRS and RMDQ, which strengthens the internal validity of findings. However, several limitations merit discussion. The relatively small sample size ($n = 26$) limits the statistical power and the ability to detect subtle intergroup differences, particularly in pain scores where the between-group p -value narrowly missed conventional significance. Furthermore, the single-center design and convenience sampling restrict generalizability to broader populations. The short duration of follow-up (six weeks) also precludes conclusions regarding long-term efficacy and recurrence prevention. Additionally, potential psychosocial factors such as fear-avoidance beliefs or baseline physical activity levels were not assessed and may have influenced outcomes.

Despite these limitations, the study's design, use of objective biofeedback tools for intervention fidelity, and adherence to CONSORT guidelines enhance its credibility. The results have important implications for clinical practice, emphasizing the integration of core stabilization as a primary component in NSCLBP rehabilitation. Given the high prevalence of chronic low back pain and the pressing need for cost-effective, accessible interventions, V-Sitting Postural Stabilization exercises can be

recommended as a non-pharmacological alternative with significant potential to reduce disability and improve quality of life.

Future research should explore the long-term sustainability of these benefits through extended follow-up periods and investigate the additive value of combining core and hip strengthening strategies in hybrid protocols. Larger multicenter trials with stratified randomization and subgroup analysis by pain chronicity, occupation, and psychosocial profiles may further delineate the patient populations most likely to benefit. Incorporating imaging or electromyographic assessments could also elucidate the physiological underpinnings of treatment responses and enhance individualized treatment planning. Ultimately, this study contributes to the growing body of literature favoring active, targeted rehabilitation over passive or isolated therapeutic approaches for chronic low back pain (28, 29).

CONCLUSION

This randomized controlled trial concluded that both V-Sitting Posture Stabilization and Modified Clamshell Exercises were effective in reducing pain and disability in individuals with non-specific chronic low back pain; however, V-Sitting exercises demonstrated superior outcomes, particularly in improving functional disability. These findings underscore the clinical relevance of incorporating dynamic core stabilization strategies—such as V-Sitting Posture Stabilization—into rehabilitation protocols for chronic low back pain, as they offer enhanced neuromuscular control and spinal stability. For clinical practice, this suggests a shift toward integrative core-focused regimens for optimal functional recovery, while future research should explore long-term outcomes, scalability, and patient-specific responsiveness to refine evidence-based exercise prescriptions.

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