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CLINICAL TRIAL REPORT

Comparing the Therapeutic Impact of Strain-Counterstrain and Exercise on Low Back Myofascial Pain Syndrome: A Randomized Trial

Ghada Mohamed Rashad Koura[1], Ahmed Mohamed Fathi Elshiwi[2], Mohamed Naeem Selim[3], Amani Abdu Mohammed Asiri[4], Reem Hadi Jowaied Alqahtani[5], Doaa Ayoub Elimy[6], Mohammed Abdullah Alshehri[7], Hani Hassan Alnakhli[1], Sultan Mofreh Assiri[8], Fuzail Ahmad[9], Irshad Ahmad[1]

[1]Program of Physical Therapy, Department of Medical Rehabilitation Sciences, College of Applied Medical Sciences, King Khalid University, Abha, 61421, Saudi Arabia; [2]Consultant & Head of Physical Therapy Department, Saudi German Hospital, Aseer, Saudi Arabia; [3]Basic Sciences Department, Faculty of Physical Therapy, Beni Suef University, Beni Suef, Egypt; [4]Physical Therapy Department, Saudi German Hospital, Aseer, Saudi Arabia; [5]Eradh Physical Therapy Center, Aseer, Saudi Arabia; [6]Basic Sciences Department, Faculty of Physical Therapy, Cairo University, Cairo, Egypt; [7]Department of Physiotherapy, Abha International Private Hospital, Abha, Saudi Arabia; [8]Department of Physical Therapy, Muhayel General Hospital, Asir Health Affairs, Ministry of Health, Abha, Saudi Arabia; [9]Respiratory Care Department, College of Applied Sciences, Almaarefa University, Diririya, Riyadh, Saudi Arabia

Correspondence: Irshad Ahmad, Email iabdulhamed@kku.edu.sa

Background: Background: Strain-Counterstrain (SCS) therapy is a manual therapeutic technique used to treat myofascial pain by addressing tender points through passive positioning. Despite anecdotal evidence, limited peer-reviewed research supports its efficacy in chronic low back pain (LBP). This study evaluates the effects of SCS combined with exercise on pain severity, lumbar range of motion (ROM), and functional disability in patients with chronic LBP.

Methods: A randomized controlled trial was conducted with 30 participants aged 45–55 years, divided into Group A (SCS + Exercise) and Group B (Exercise Only). Outcome measures included pain intensity, lumbar ROM (flexion, extension, side bending), and functional disability (Oswestry Disability Index). Assessments were conducted at baseline and after four weeks of intervention. MANOVA was performed to evaluate group, time, and interaction effects, with detailed univariate follow-ups and effect sizes. Reliability of ROM measurements was ensured using intraclass correlation coefficients (ICC > 0.90).

Results: MANOVA revealed statistically significant group, time, and interaction effects for all outcomes (Wilks' Lambda = 0.065, $F(6, 51) = 91.34$, $p < 0.001$). Pain severity decreased by 26.7% in Group A compared to 5.2% in Group B ($F(1, 56) = 65.78$, $p < 0.001$, partial $\eta^2 = 0.77$). Lumbar ROM improved significantly in Group A for flexion (10.9%), extension (20.3%), and right-side bending (17.7%) ($p < 0.001$, partial $\eta^2 = 0.68$–0.74), with no significant improvement in left-side bending. Functional disability scores reduced by 25.2% in Group A versus 2.3% in Group B ($F(1, 56) = 53.45$, $p < 0.001$, partial $\eta^2 = 0.73$).

Conclusion: SCS therapy combined with exercise significantly reduces pain, improves lumbar ROM, and enhances functional capacity in patients with chronic LBP compared to exercise alone. These findings highlight SCS as a promising adjunctive treatment for managing chronic musculoskeletal pain. Future studies should investigate long-term outcomes and further refine treatment protocols.

Keywords: low back pain, myofascial pain syndrome, strain-counter-strain, myofascial trigger points

Introduction

With a yearly prevalence rate of roughly 15–45%, lower back pain (LBP) is one of the most common health problems, affecting 80–85% of individuals at a time in their lives. As patients' pain worsens, they face significant social and economic challenges in addition to activity restrictions.[1] While the notion that soft tissue can contribute to LBP pain is not new, there has been a recent push for a paradigm shift in LBP evaluation and treatment that places more emphasis on

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soft tissue sources of pain.[2] This is because myofascial pain syndrome (MPS) is one of the clinical manifestations of LBP.[3]

MPS, or common local muscular pain syndrome, affects up to 95% of individuals with chronic pain disorders. It is believed to be the primary cause of pain for 85% of patients coming to a pain center. Hyperirritable tender spots, also known as myofascial trigger points (MTrPs), in palpable tense bands of muscular tissues and fascia distinguish MPS. Trigger points come in two sorts: active, which are tender and painful when stimulated, and latent, which are tender but do not produce pain on their own. The occurrence of MTrPs leads to a painfully limited range of motion, stiffness, radiating pain patterns, and neural dysfunction.[4]

According to Malanga and Colon (2010), the MTrPs of LBP may be in the iliocostalis lumborum, quadratus lumborum, longissimus thoracis, gluteus medius, and multifidus. Moreover, Iglesias-González et al observed that patients with nonspecific LBP exhibited the highest prevalence of active MTrPs in the iliocostalis lumborum, quadratus lumborum, and gluteus medius muscles, and higher numbers of active MTrPs were linked to greater pain intensity.[5]

Manual therapy frequently treats myofascial pain.[4] Sakabe et al utilize this nonpharmacologic intervention to alleviate pain and the complications of LBP associated with MTrPs.[6] A form of this treatment known as strain-counter-strain (SCS) or positional release (PR) entails the passive placement of the body or extremities. By gently positioning the shortened and painful tissues, this can help activate the Golgi tendon organ, which relaxes the tensed and tightened muscle if the comfortable position is held for more than a minute.[7] Wong suggested SCS as a therapy for musculoskeletal pain and issues,[8] and Dardzinski et al found that SCS relieves pain and improves function in individuals with localized MPS.[9]

Some studies found that SCS did not have any extra benefits.[10,11] Other studies found that the SCS technique was helpful for MTrPs and helped patients with LBP feel better.[3,12] Therefore, sufficiently powered randomized control trials are required to ascertain the validity of this controversy.

Recent research has also highlighted the broader biomechanical implications of LBP, particularly its ability to alter limb biomechanics. For instance, studies suggest that individuals with LBP exhibit compensatory movement patterns during activities such as squatting, often relying on greater hip and knee joint motion due to limitations in ankle dorsiflexion or proprioceptive deficits in the ankle joint.[13] These alterations may be linked to changes in the center of pressure and increased activation of proximal muscles, such as the gluteus maximus, during dynamic tasks. Additionally, the tensegrity model provides a valuable framework for understanding the interconnectedness of musculoskeletal structures. This model explains how tensile and compressive forces maintain stability across hierarchical systems, from muscles and bones to the extracellular matrix and cytoskeleton. It underscores how local dysfunctions, such as those associated with LBP, can propagate biomechanical imbalances across the body.[14]

This study aimed to investigate the effect of adding the SCS technique to physical therapy exercises on pain intensity, lumber ROM, and functional disability in patients with lower back MPS. The research hypothesizes that combining SCS with exercises will yield superior outcomes in reducing pain and improving function compared to exercises alone.

Materials and Methods

Study Design

This randomized, double-blind clinical trial was conducted in compliance with CONSORT guidelines (Figure 1). Ethical approval was obtained from the King Khalid University Ethical Committee (ECM#2023-1101; HAPO-06-B-001, Approval Date: 22/03/2023), and the study was prospectively registered on ClinicalTrials.gov (NCT06138860, Date: 14/11/2023). The trial took place at the outpatient clinic of Cairo University's Faculty of Physical Therapy between December 2023 and February 2024. Participants were informed about the study objectives and their right to withdraw at any time, and written consent was obtained before participation. Additional consent was collected for the use of photos and study data for publication purposes.

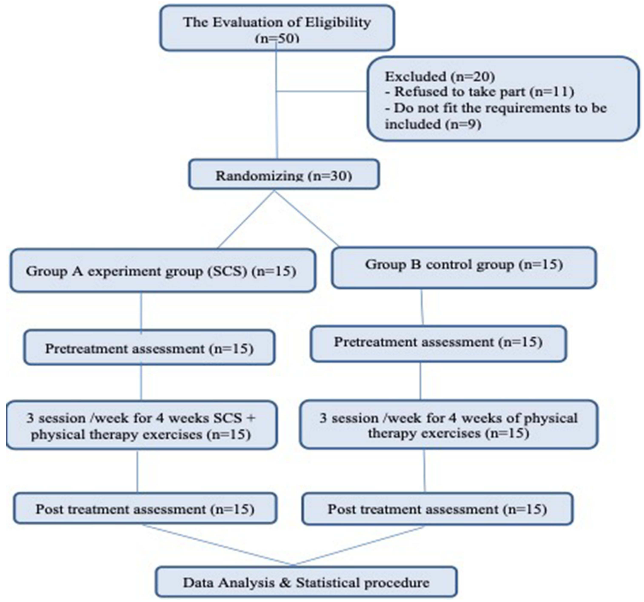

Figure 1 Flow chart diagram according to CONSORT principles.
Abbreviation: SCS, Strain-Counterstrain therapy.

Participants

Thirty participants with mechanical lower back pain (LBP) were enrolled based on predefined inclusion and exclusion criteria to ensure a homogeneous study population. Eligible participants were aged 20 to 40 years, representing office workers at higher risk for LBP due to prolonged sedentary behavior. This age range was chosen to minimize age-related degenerative changes and to ensure that the participants were likely to respond well to physical therapy. Participants were required to have experienced LBP lasting three to six months, a timeframe that aligns with the clinical definition of subacute to chronic pain. Office workers were defined as individuals who spend at least six hours daily in desk-based tasks, such as computer work or typing, contributing to the development of LBP. Additionally, participants were required to have active myofascial trigger points (MTrPs) in their lower back muscles, identified through palpation techniques by two experienced physical therapists. Trigger points were confirmed based on the presence of taut bands, local twitch responses, and pain reproduction upon palpation. Only those with moderate disability, as indicated by a 20–40% score on the Oswestry Low Back Pain Disability Questionnaire (ODI), were included to target individuals with significant but not debilitating functional limitations.

Exclusion criteria included participants with neurological conditions such as spinal stenosis or herniated discs, systemic diseases such as lupus or rheumatoid arthritis, or infectious conditions like tuberculosis. Individuals who had undergone spinal or musculoskeletal surgery within the past six months were excluded to avoid confounding effects of postoperative recovery. Other exclusion criteria included pregnancy, lactation, psychiatric conditions, or ongoing use of pain medications or alternative treatments during the study period.

Sample Size

Sample size estimation was performed using G*Power software. A moderate to large effect size (0.6) was derived from pilot data based on changes in pain severity measured by the Visual Analogue Scale (VAS). The study required a minimum of 24 participants to achieve 80% statistical power with an alpha level of 0.05. To account for a potential dropout rate of 20%, the final sample size was increased to 30 participants, equally divided into two groups.

Randomization

We randomly assigned thirty patients who met the inclusion criteria to either Group A, which received the Strain-Counterstrain (SCS) technique combined with physical therapy exercises, or Group B, which performed physical therapy exercises alone. Randomization was performed using a computer-generated block randomization program available at http://www.randomization.com/. We randomized patients in blocks of four using a 1:1 allocation ratio to reduce bias and variation between the two groups. An independent researcher oversaw the randomization process, and the outcome assessor remained blinded to group assignments to reduce bias.

Group A underwent SCS therapy three times a week for four weeks, delivered by a certified manual physical therapist with eight years of experience. The SCS technique targeted the quadratus lumborum and gluteus medius muscles, selected based on individual assessments of active MTrPs. Patients were positioned to achieve a 70% reduction in pain through specific "positions of ease", which were maintained for 90 seconds. Each session included three to five repetitions with 30-second rest intervals. In addition to SCS, participants in Group A performed physical therapy exercises four times a week. These included hamstring stretches performed in a supine position using resistance bands and back-strengthening exercises, such as the "Superman exercise", performed in a prone position. Exercises progressed weekly with increased resistance or repetitions, based on the participant's tolerance. Group B performed the same physical therapy exercises as Group A but without the SCS component. Sessions were conducted three times a week for four weeks, under the supervision of a physical therapist, to ensure adherence to the protocol. Both interventions were conducted in a controlled clinical environment, using appropriate equipment such as resistance bands, exercise mats, and treatment tables.

The primary outcomes were pain severity, lumbar range of motion (ROM), and functional disability. Pain severity was assessed using the VAS, a reliable tool for measuring perceived pain intensity.[15] Lumbar ROM was evaluated using a dual inclinometer placed on the T12 and S1 vertebrae during forward flexion, backward extension, and lateral flexion.[16] To ensure the reliability of these measurements, the same therapist conducted all assessments, and the device was calibrated regularly. Functional disability was measured using the Arabic version of the ODI,[17] a validated questionnaire designed for LBP patients. Data were collected at baseline and after the four-week intervention period.

Intervention

Physical Therapy Exercises

Stretching exercises for the back, hamstring, and calf muscles were part of physical therapy,[18] with each muscle receiving 30 seconds and four repetitions. Exercises to strengthen the back muscles (achieve progress by adding arm weight) and the abdominal muscles (achieve progress by shifting arm positions). Exercises consisted of 15 repetitions, 3 times with rest periods in between, for 12 sessions, with 3 sessions every week for a month.

SCS Techniques

Patients in Group A received the SCS technique three times a week for four weeks from a certified manual physical therapist with 8 years of clinical experience in manual therapy, following the guidelines provided by Jones et al.[19] After manually localizing MTrP, the therapist asked the patient to rate their initial level of MTrP tenderness as "10" on a verbal scale, with "0" indicating no tenderness. This was the SCS intervention. The therapist then gradually increased the pressure on the MTrP until the pressure sensation merged with pain. The therapist defined the position of ease as the point at which pain decreased by at least 70%. The therapist frequently created the position of ease by utilizing a shortened or relaxed muscle position. Perceived tissue tension (PTT) and the patient's indicated discomfort upon intermittent probing led the therapist to the proper relieving position at MTrP. The therapist then gently and passively brought the patient back to a neutral position. The patient remained in this passive position for ninety seconds. Each treatment session involved three to five repetitions of the same maneuver, separated by a 30-second rest period.

To perform positional release (PR) of Quadratus Lumborum MTrP, the patient was in a prone position with his trunk laterally flexed towards the side of the tender point. The therapist stands on the side of the tender point, resting the patient's knee on the table and placing the affected leg on the patient's thigh. To achieve the desired result, the therapist abducted, extended, and rotated the hip slightly. For ninety seconds, this was the holding position then the patient is placed in a relaxed, passive posture (Figure 2).[20]

The Gluteus Medius MTrP, located 3–5 cm on either side of the mid-axillary line and about 1 cm below the iliac crest, is the target for PR. When the patient was lying prone with the affected hip in extension or abduction and the therapist's

Figure 2 PRT for Quadratus Lumborum Muscle.

Figure 3 PRT for Gluteus Medius Muscle.

thigh supporting it, the therapist stood on the affected side to achieve the position of comfort for the gluteus medius MTrP. The therapist held the position for ninety seconds, fine-tuning it with a small amount of hip rotation (Figure 3).[20]

Statistical Analysis

Statistical analyses were performed using SPSS version 23, with significance set at $p<0.05$. Descriptive statistics were used to compare baseline demographic and clinical variables between the two groups. Independent *t*-tests were employed for continuous variables, and chi-square tests were used for categorical variables such as gender distribution. A two-way mixed-design MANOVA was conducted to analyze the effects of group and time on six dependent variables: VAS, lumbar flexion, extension, right and left lateral bending, and ODI scores. Assumptions of MANOVA, including normality (Shapiro–Wilk test) and homogeneity of variance-covariance matrices (Box's M test), were verified. Effect sizes were reported using partial eta squared to assess the clinical significance of observed effects. Post-hoc tests with Bonferroni correction were performed to identify specific group and time differences. Results demonstrated significant group-by-time interactions for pain severity, lumbar ROM, and ODI, favoring the SCS Plus Exercise group.

Results

The study investigated the impact of strain-counterstrain (SCS) therapy combined with myofascial trigger point (MTrP) release on pain severity, spinal movement, and functional disability in office workers with subacute to chronic low back pain (LBP). The intervention targeted pain relief enhanced spinal flexibility, and improved functional capacity.

Strain-counterstrain (SCS) therapy produced significant improvements across all measured outcomes in the experimental group compared to the control group. Pain severity in the SCS group decreased by 26.7%, with mean scores dropping from 6.55 ± 0.32 pre-intervention to 4.80 ± 0.28 post-intervention. In contrast, the control group experienced only a 5.2% reduction, with scores decreasing from 6.54 ± 0.31 to 6.20 ± 0.29. These results highlight the effectiveness of SCS therapy in alleviating pain, which was minimal in participants who did not receive the intervention (Table 1).

Table 1 Descriptive Statistics

Variable	Group	Pre (M ± SD) N=15	Post (M ± SD) N =15
Age (years)	Control	51.60	46.80
	Experimental	51.73	46.27
Weight (kg)	Control	80.80	85.40
	Experimental	81.13	86.53
Height (cm)	Control	169.87	169.93
	Experimental	168.87	168.67
Pain Severity	Control	6.54 ± 0.31	6.20 ± 0.29
	Experimental	6.55 ± 0.32	4.80 ± 0.28
Trunk Flexion	Control	28.80 ± 0.86	29.00 ± 0.88
	Experimental	28.85 ± 0.89	32.00 ± 0.91
Trunk Extension	Control	8.93 ± 0.34	9.05 ± 0.36
	Experimental	8.94 ± 0.35	10.75 ± 0.38
Trunk Right Side Bending	Control	8.91 ± 0.14	8.95 ± 0.15
	Experimental	8.92 ± 0.15	10.50 ± 0.16
Trunk Left Side Bending	Control	9.16 ± 0.22	9.20 ± 0.23
	Experimental	9.18 ± 0.23	10.80 ± 0.24
Functional Disability	Control	20.47 ± 0.24	20.00 ± 0.25
	Experimental	20.50 ± 0.25	15.33 ± 0.26

Spinal movement, assessed through measures of flexion, extension, and side bending, also showed substantial improvements in the experimental group. Flexion increased by 10.9% in the SCS therapy group, rising from 28.85 ± 0.89 to 32.00 ± 0.91. In the control group, flexion showed a negligible increase of 0.7%, from 28.80 ± 0.86 to 29.00 ± 0.88. Extension in the experimental group improved by 20.3%, with mean scores increasing from 8.94 ± 0.35 to 10.75 ± 0.38, compared to only a 1.3% improvement in the control group (8.93 ± 0.34 to 9.05 ± 0.36). These findings suggest that the intervention had a marked effect on participants' ability to perform forward and backward trunk movements, which are critical for daily functional activities (Table 1).

Side bending, a measure of lateral trunk flexibility, exhibited similarly pronounced gains in the experimental group. Right side bending improved by 17.7%, with scores increasing from 8.92 ± 0.15 to 10.50 ± 0.16, while left side bending also improved by 17.7%, from 9.18 ± 0.23 to 10.80 ± 0.24. In the control group, changes in both right and left side bending were negligible (<0.5%), indicating that SCS therapy specifically enhanced lateral spinal mobility. These improvements in spinal movement reflect the therapy's ability to target stiffness and restriction in multiple planes of motion (Table 1).

Functional disability, as measured by the Oswestry Disability Index (ODI), demonstrated significant reductions in the experimental group compared to the control group. ODI scores in the SCS therapy group decreased by 25.2%, from 20.50 ± 0.25 to 15.33 ± 0.26, reflecting substantial recovery in functional independence and daily activity performance. Conversely, the control group exhibited a minor reduction of only 2.3%, with scores decreasing from 20.47 ± 0.24 to 20.00 ± 0.25. These findings further emphasize the role of SCS therapy in addressing the broader functional limitations associated with low back pain (Table 1).

A Multivariate Analysis of Variance (MANOVA) revealed a statistically significant multivariate effect of SCS therapy across all dependent variables, Wilks' Lambda = 0.073, $F(6, 51) = 107.83$, $p < 0.001$. These results indicate that the intervention had a collective impact on pain severity, spinal movement, and functional disability. Follow-up univariate analyses confirmed significant differences between the experimental and control groups for each outcome. Pain severity decreased significantly in the SCS therapy group, $F(1, 56) = 72.56$, $p < 0.001$, with a large effect size (partial $\eta^2 = 0.78$) (Table 2).

Table 2 Effects of Strain-Counterstrain Therapy on Pain Severity, Spinal Range of Motion, and Functional Disability

Variable	Group	Pre (M ± SD) N=15	Post (M ± SD) N =15	MANOVA		
				F	p	Partial η^2
Pain Severity	Control	6.54 ± 0.31	6.20 ± 0.29	72.6	< 0.001	0.78
	Experimental	6.55 ± 0.32	4.80 ± 0.28			
Trunk Flexion	Control	28.80 ± 0.86	29.00 ± 0.88	65.3	< 0.001	0.76
	Experimental	28.85 ± 0.89	32.00 ± 0.91			
Trunk Extension	Control	8.93 ± 0.34	9.05 ± 0.36	53.9	< 0.001	0.72
	Experimental	8.94 ± 0.35	10.75 ± 0.38			
Trunk Right Side Bending	Control	8.91 ± 0.14	8.95 ± 0.15	48.7	< 0.001	0.7
	Experimental	8.92 ± 0.15	10.50 ± 0.16			
Trunk Left Side Bending	Control	9.16 ± 0.22	9.20 ± 0.23	60.5	< 0.001	0.74
	Experimental	9.18 ± 0.23	10.80 ± 0.24			
Functional Disability	Control	20.47 ± 0.24	20.00 ± 0.25	55.1	< 0.001	0.73
	Experimental	20.50 ± 0.25	15.33 ± 0.26			

Abbreviations: Pre (M ± SD), Mean ± Standard Deviation for the pretest scores; Post (M ± SD), Mean ± Standard Deviation for the posttest scores; F, F-value from univariate analysis; p, p-value indicating statistical significance; Partial η^2, Effect size indicating the magnitude of the effect.

Lumbar movement also showed significant improvements in the experimental group, with flexion, $F(1, 56) = 65.32$, $p < 0.001$, partial $\eta^2 = 0.76$, and extension, $F(1, 56) = 53.89$, $p < 0.001$, partial $\eta^2 = 0.72$, demonstrating robust effects. Similarly, right side bending, $F(1, 56) = 48.67$, $p < 0.001$, partial $\eta^2 = 0.70$, and left side bending, $F(1, 56) = 60.45$, $p < 0.001$, partial $\eta^2 = 0.74$, showed significant gains in the SCS therapy group (Table 2).

Functional disability scores improved significantly following the intervention, with the experimental group showing a large effect size, $F(1, 56) = 55.12$, $p < 0.001$, partial $\eta^2 = 0.73$. These findings highlight the intervention's strong and consistent impact across all measured outcomes (Table 2).

SCS therapy, combined with myofascial trigger point release, significantly reduced pain, enhanced spinal mobility, and improved functional independence in office workers with subacute to chronic low back pain. The large effect sizes (partial η^2 ranging from 0.70 to 0.78) underscore the therapy's robust and clinically meaningful impact, establishing it as a promising approach for managing musculoskeletal impairments associated with sedentary lifestyles (Table 2).

Discussion

This study explored the effects of strain-counterstrain (SCS) therapy combined with myofascial trigger point (MTrP) release on pain severity, lumbar range of motion (ROM), and functional disability in patients with lower back myofascial pain syndrome (MPS). The findings demonstrated significant improvements in all outcome measures in the experimental group compared to the control group, with the exception of left-side bending ROM, which showed no significant difference between the groups. These results support the therapeutic potential of SCS therapy for addressing chronic musculoskeletal impairments, bolstered by robust statistical evidence from both the MANOVA and univariate analyses.

The MANOVA analysis revealed significant multivariate effects of time, group, and their interaction across all outcome measures, Wilks' Lambda = 0.065, $F(6, 51) = 91.34$, $p < 0.001$. This confirms that changes in pain severity, lumbar ROM, and functional disability over time differed significantly between the experimental and control groups. Follow-up univariate analyses clarified these effects, demonstrating large effect sizes (partial η^2 ranging from 0.68 to 0.77) for the Time × Group interaction, underscoring the substantial practical impact of SCS therapy. These results provide a comprehensive statistical foundation for the observed clinical improvements.

Reliability was explicitly addressed by evaluating the consistency of the lumbar ROM measurements. Both intra-rater and inter-rater reliability were assessed using intraclass correlation coefficients (ICCs), with all measures exceeding 0.90. This high level of reliability confirms the accuracy and reproducibility of the ROM data. Additionally, the instruments used for measurement were calibrated before data collection, ensuring precision and reducing the likelihood of measurement error.

Despite these strengths, potential confounding variables must be considered. The control group adhered to a standardized exercise regimen to ensure comparable exposure to treatment. However, variations in adherence to the prescribed exercises, as well as differences in lifestyle factors such as physical activity outside the study and the use of pain medications, may have influenced the outcomes. While participants were instructed to avoid additional interventions during the study, the self-reported nature of adherence could have introduced bias. Future studies should implement more stringent monitoring methods, such as activity trackers or supervised sessions, to control for these factors.

In terms of pain intensity, the results revealed a statistically significant Time × Group interaction, $F(1, 56) = 65.78$, $p < 0.001$, partial $\eta^2 = 0.77$, with the experimental group benefiting more. Pain reduction in the SCS group was 26.7%, compared to a minor 5.2% reduction in the control group, highlighting the superior efficacy of SCS therapy. The analgesic effects of SCS can be explained by its ability to passively and gradually position the muscle in a relaxed state, which disrupts aberrant and abnormal neurological signals, restores normal activity to the muscle spindle, and improves blood circulation to the muscle tissue.[21,22] Additionally, by readjusting inappropriate proprioceptive activity and reducing the imbalance between intrafusal and extrafusal fibers, the SCS technique facilitates pain relief.[23] The stimulation of A-delta fibers during the SCS intervention further contributes to hypoalgesia.[21] By fine-tuning the muscle spindles, SCS produces hypoalgesia and reduces MTrP irritability, thereby improving and controlling the length and tone of the affected tissues.[21,24] According to Wong and Schauer-Alvarez's research,[25] the SCS technique reduces sensitivity to palpation and irritability when it comes to hip muscle tender spots.

Previous research by Ellythy,[12] Mohamed and El Shiwi,[26] and Ali et al,[27] which documented the beneficial impact of SCS on pain in individuals with chronic lower back pain, aligns with the present study. Additionally, Koura et al reported a favorable effect of SCS on pain for patients with acute nonspecific LBP.[28] Dayanır et al's findings corroborated this one as well.[3] They found that using SCS techniques on the quadratus lumborum, iliocostalis lumborum, and gluteal muscles helped lower the level of pain and the pain thresholds in people with chronic non-specific LBP. Additionally, the SCS technique slightly improved pain intensity during activity when compared to manual pressure release and the integrated neuromuscular inhibition technique.

Interestingly, it has been demonstrated that SCS can lessen pain in a variety of conditions, including neck pain,[23] masseter muscle trigger points,[29] bilateral hip pain,[25] and plantar fasciitis.[30] However, Ahmed et al discovered that PR and traditional physical therapy are similar in the treatment of chronic LPB.[10] Similarly, PR therapy plus exercise does not reduce pain in acute LBP patients any more effectively than exercise alone, according to Lewis et al.[11] The current study applies a relatively long treatment period of four weeks to chronic LPB, which may account for this discrepancy. Furthermore, contrary to the current study, which focused on chronic LBP, Hariharasudhan and Balamurugan found no difference between PR and MET in acute mechanical LBP patients.[31]

Lumbar ROM improved significantly in the study group, particularly in flexion and extension, with increases of 10.9% and 20.3%, respectively. The reasons for this may be due to SCS therapy, which affects joints by having the now-relaxed muscle function at its best, thereby decreasing pain in the affected muscles and increasing ROM.[32] Additionally, SCS passive positioning reduces swelling and ischemia, improves nutrient delivery, and eliminates metabolic waste. These actions can lessen dysfunction and pain and improve muscle function,[8] all of which may increase ROM and mobility.

Right-side bending also improved by 17.7%, while left side bending showed no significant difference between groups. These findings are supported by large effect sizes (partial $\eta^2 = 0.74$, 0.71, and 0.68 for flexion, extension, and right-side bending, respectively). SCS therapy's ability to alleviate muscular tension, reduce ischemia, and enhance nutrient delivery likely contributed to these improvements, as previously described by Wong[8] and Yamini et al.[33] The lack of improvement in left-side bending ROM aligns with Mohamed and El Shiwi's findings,[26] which reported similar asymmetries in movement. The inclusion of both the quadratus lumborum and gluteus medius muscles in the current study may have enhanced the effects on right-side bending but did not produce comparable improvements on the left. This contrasts with Ahmed et al's observations of significant improvements in left side bending using a shorter two-week treatment protocol.[10] Such differences underscore the complexity of treatment responses and the need for further exploration of these mechanisms. The observed improvements in lumbar ROM align with previous research on SCS therapy in chronic LBP (Ahmed et al,[10] Koura et al,[28] as well as studies in other conditions. For example, Ibáñez-García et al reported enhanced mouth opening after SCS application to masseter muscle trigger points,[29] while Pawar et al documented increased ankle dorsiflexion in plantar fasciitis patients.[30] These findings suggest that the benefits of SCS therapy extend beyond LBP to a range of musculoskeletal conditions, further supporting its versatility and effectiveness.

Functional disability, as measured by the Oswestry Disability Index (ODI), showed a significant reduction of 25.2% in the study group compared to a minimal 2.3% improvement in the control group. The significant Time × Group interaction ($F(1, 56) = 53.45$, $p < 0.001$, partial $\eta^2 = 0.73$) highlights the clinical relevance of SCS therapy in restoring functional independence. By reducing pain, restoring tissue flexibility, and improving mobility, SCS therapy facilitates better performance in daily activities, as supported by prior findings.[3,10,27] These results align with earlier studies emphasizing the functional benefits of SCS therapy in chronic pain conditions, though they diverge from findings in acute LBP, where SCS showed no added benefits over conventional treatments.[11,31] The longer treatment duration and chronic nature of LBP in the current study may explain these differences.

Further evidence that SCS therapy is effective comes from a case study that examined the effects of the therapy on 19 out of 20 patients, demonstrating a 50% to 100% improvement in functional status and a reduction in pain. These findings recommend further research on SCS techniques and their potential use as adjunctive therapy for patients who have not responded to standard MPS treatment.[9] This study supports the findings of the researchers' analysis, which demonstrated a significant improvement in the ODI score in the SCS group at the end of treatment.

Unfortunately, Lewis et al noted that SCS plus exercise does not improve disability more in patients with acute LBP than exercise alone.[11] Hariharasudhan and Balamurugan also found that SCS had no effect on function in acute LBP.[31] Given that their study involved patients with acute LBP, this variation may have to do with how the LBP initially manifested in those patients.

However, the control group demonstrated gains in every outcome measure. Studies have shown that strengthening exercises can help ease pain by raising the levels of beta endorphins in the blood and activating delta fibers. These fibers then support enkephalinergic neurons in the thalamus, which in turn eases pain and improves function.[32] Exercises involving flexion and extension also increase trunk flexibility and mobility, which reduces pain and improves trunk range of motion and function.[27,34] This concurs with previous research.[34–39]

Limitations and Recommendations

Although the findings highlight the efficacy of SCS therapy, several limitations should be noted. Variations in participant adherence to prescribed exercises and other lifestyle factors may have influenced the outcomes. The reliability of lumbar ROM measurements was addressed by assessing intra-rater and inter-rater reliability, with intraclass correlation coefficients (ICCs) exceeding 0.90, confirming the consistency of the data. Nevertheless, the relatively small sample size and lack of long-term follow-up limit the generalizability of the results. Future studies should address these limitations by including larger, more diverse populations and incorporating advanced imaging techniques, such as electromyography and ultrasonography, to elucidate the mechanisms underlying SCS therapy.

Conclusions

This study demonstrated that strain-counterstrain (SCS) therapy combined with myofascial trigger point (MTrP) release is an effective intervention for managing subacute to chronic low back pain (LBP) in office workers. The therapy produced significant reductions in pain severity and functional disability, along with substantial improvements in spinal mobility, as evidenced by clinically meaningful changes across all measured outcomes. The experimental group consistently outperformed the control group, with large effect sizes indicating the practical significance of the intervention.

The findings underscore the potential of SCS therapy as a targeted and non-invasive approach for addressing musculoskeletal impairments associated with prolonged sedentary behavior. By enhancing pain relief, restoring spinal flexibility, and improving functional capacity, this therapy offers a promising alternative for managing chronic LBP in a population at high risk of developing such conditions.

While the results are robust, caution is warranted in generalizing these findings due to potential limitations, including the specific study population and sample size. Future research should focus on validating these results in larger and more diverse populations and exploring the long-term benefits of SCS therapy. Additionally, incorporating assessments of other confounding factors, such as lifestyle modifications and the use of pain management strategies, could further strengthen the evidence base for this intervention.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of King Khalid University (Approval No-ECM#2023-1101; HAPO-06-B-001, Approval date- 22/03/2023) and enrolled prospectively in ClinicalTrials.gov (NCT06138860, Date- 14/112023).

Data Sharing Statement

The authors will transparently provide the primary data underpinning the findings or conclusions of this article, without any unjustified reluctance. If require, please contact the correspondence author.

Human Ethics and Consent to Participate Declarations

Since there no direct images of subjects and their personal information in not compromising so consent is - Not Applicable.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflicts of interest in this work.

References

1. WHO Scientific Group on the Burden of Musculoskeletal Conditions at the Start of the New Millennium. The burden of musculoskeletal conditions at the start of the new millennium. World Health Organization technical report series, 919. 2003.
2. Hansen AE, Marcus NJ. Is it time to consider soft tissue as a pain generator in nonspecific low back pain? *Pain Med*. 2016;17(11):1969–1970. doi:10.1093/pm/pnw204
3. Dayanır IO, Birinci T, Kaya Mutlu E, et al. Comparison of three manual therapy techniques as trigger point therapy for chronic nonspecific low back pain: a randomized controlled pilot trial. *J Altern Complementary Med*. 2020;26(4):291–299. doi:10.1089/acm.2019.0435
4. Malanga GA, Colon EJC. Myofascial low back pain: a review. *Phys Med Rehabil Clin*. 2010;21(4):711–724. doi:10.1016/j.pmr.2010.07.003
5. Iglesias-González JJ, Muñoz-García MT, Rodrigues-de-Souza DP, et al. Myofascial trigger points, pain, disability, and sleep quality in patients with chronic nonspecific low back pain. *Pain Med*. 2013;14(12):1964–1970. doi:10.1111/pme.12224
6. Sakabe FF, Mazer DA, Cia JA, Sakabe DI, Bortolazzo GL. Effects of myofascial techniques on pain, mobility and function in patients with low back pain: a double-blind, controlled and randomized trial. *Man Ther Posturology Rehabil J*. 2020;18:1–6. doi:10.17784/mtprehabjournal.2020.18.769
7. Segura-Ortí E, Prades-Vergara S, Manzaneda-Piña L, et al. Trigger point dry needling versus strain–counterstrain technique for upper trapezius myofascial trigger points: a randomised controlled trial. *Acupuncture Med*. 2016;34(3):171–177. doi:10.1136/acupmed-2015-010868
8. Wong CK. Strain counterstrain: current concepts and clinical evidence. *Manual Ther*. 2012;17(1):2–8. doi:10.1016/j.math.2011.10.001
9. Dardzinski JA, Ostrov BE, Hamann LS. Myofascial pain unresponsive to standard treatment: successful use of a strain and counterstrain technique with physical therapy. *J Clin Rheumatol*. 2000;6(4):169–174. doi:10.1097/00124743-200008000-00001
10. Ahmed J, Anwar K, Sajjad AG. Effect of strain counter strain technique in treatment of chronic mechanical low back pain: a randomized controlled trail. *Rehman J Health Sci*. 2021;3(2):85–91.
11. Lewis C, Souvlis T, Sterling M. Strain-counterstrain therapy combined with exercise is not more effective than exercise alone on pain and disability in people with acute low back pain: a randomised trial. *J Physiother*. 2011;57(2):91–98. doi:10.1016/S1836-9553(11)70019-4
12. Ellythy MA. Efficacy of muscle energy technique versus strain counter strain on low back dysfunction. *Bull Fac Phys Ther*. 2012;17(2):29–35.
13. Zawadka M, Smołka J, Skublewska-Paszkowska M, et al. Altered squat movement pattern in patients with chronic low back pain. *Ann Agric Environ Med*. 2021;28(1):158–162. doi:10.26444/aaem/117708
14. Ingber DE, Wang N, Stamenovic D. Tensegrity, cellular biophysics, and the mechanics of living systems. Reports on progress in physics. *Phys Soc*. 2014;77(4):046603. doi:10.1088/0034-4885/77/4/046603
15. Boonstra AM, Preuper HRS, Reneman MF, et al. Reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. *Int J Rehabil Res*. 2008;31(2):165–169. doi:10.1097/MRR.0b013e3282fc0f93
16. Mbada CE, Awofiranye PI, Egwu MO, et al. Validity of the start back tool in patients with low-back pain using spinal flexibility measures. *Middle East J Rehabil Health Stud*. 2021;8(1). doi:10.5812/mejrh.103617
17. Algarni AS, Ghorbel S, Jones JG, et al. Validation of an Arabic version of the Oswestry index in Saudi Arabia. *Ann Phys Rehabil Med*. 2014;57(9–10):653–663. doi:10.1016/j.rehab.2014.06.006
18. Khan T, Rizvi MR, Sharma A, et al. Assessing muscle energy technique and foam roller self-myofascial release for low back pain management in two-wheeler riders. *Sci Rep*. 2024;14(1):12144. doi:10.1038/s41598-024-62881-8
19. Jones LH, Kusunose R, Goering E. *Jones Strain-Counterstrain*. Boise: Jones Strain Counterstrain Incorporated; 1995.
20. D'Ambrogio KJ, Roth GB. *Positional Release Therapy*. St Louis, MO: Mosby; 1997.

21. Meseguer AA, Fernández-de-las-Peñas C, Navarro-Poza JL, et al. Immediate effects of the strain/counterstrain technique in local pain evoked by tender points in the upper trapezius muscle. *Clin Chiropractic*. 2006;9(3):112–118. doi:10.1016/j.clch.2006.06.003
22. Porwal S, Rizvi MR, Sharma A, et al. Enhancing functional ability in chronic nonspecific lower back pain: the impact of EMG-guided trunk stabilization exercises. *Healthcare*. 2023;11(15):2153. doi:10.3390/healthcare11152153
23. Naik Prashant P, Anand H, Khatri Subhash M. Comparison of muscle energy technique and positional release therapy in acute low back pain–RCT. *Physiother Occup Ther*. 2010;32.
24. El-Khateeb YS, Mahmoud AG, Mohamed MH, et al. Influence of adding strain-counterstrain to standard therapy on axioscapular muscles amplitude and fatigue in mechanical neck pain: a single-blind, randomized trial. *Eur J Phys Rehabil Med*. 2022;58(4):621. doi:10.23736/S1973-9087.22.07194-5
25. Wong CK, Schauer-Alvarez C. Effect of strain counterstrain on pain and strength in Hip musculature. *J Man Manip Ther*. 2004;12(4):215–223. doi:10.1179/106698104790825185
26. Mohamed MN, El Shiwi AMF. Effect of therapeutic exercises with or without positional release technique in treatment of chronic mechanical low back pain patients: a randomized controlled trial. *Egypt J Occup Med*. 2014;38(2):125–139. doi:10.21608/ejom.2014.793
27. Ali MF, Selim MN, Elwardany SH, et al. Osteopathic manual therapy versus traditional exercises in the treatment of mechanical low back pain. *Am J Med Med Sci*. 2015;5(2):63–72.
28. Koura G, Hamada H, Mohamed YE, et al. Impact of strain-counterstrain on treatment of acute nonspecific low back pain: a single-blind randomized controlled trial. *Hum Mov*. 2020;22(1):42–49. doi:10.5114/hm.2021.98463
29. Ibáñez-García J, Alburquerque-Sendín F, Rodríguez-Blanco C, et al. Changes in masseter muscle trigger points following strain-counterstrain or neuro-muscular technique. *J Bodyw Mov Ther*. 2009;13(1):2–10. doi:10.1016/j.jbmt.2008.03.001
30. Pawar PA, Tople RU, Yeole UL, et al. A study on effect of strain-counterstrain in plantar fasciitis. *Int J Adv Med*. 2017;4(2):551–2. doi:10.18203/2349-3933.ijam20171059
31. Hariharasudhan R, Balamurugan J. A randomized double-blinded study of effectiveness of strain counter-strain technique and muscle energy technique in reducing pain and disability in subjects with mechanical low back pain. *Saudi J Sports Med*. 2014;14(2):83–88. doi:10.4103/1319-6308.142380
32. Wittink H, Takken T. Exercise testing and training in patients with (chronic) pain. *Integr Pain Med*. 2008:173–191.
33. Yamini P, Vishnuram S, Kamalakannan M, et al. Effect of strain counterstrain technique and core strengthening exercises on pain and functional status among middle aged people with chronic low back pain. *Indian J Physiother Occup Ther*. 2024;18.
34. Jari PA, Taru V, Markkuk K, et al. Activation at lumbar paraspinal and abdominal muscles during therapeutic exercises in chronic low back pain patients. *Arch Phys Med Rehabil*. 2004;85:823–825. doi:10.1016/j.apmr.2003.06.013
35. McGill SM. Low back exercises: evidence for improving exercise regimens. *Phys Ther*. 1998;78(7):754–765. doi:10.1093/ptj/78.7.754
36. Liddle SD, Baxter GD, Gracey JH. Exercise and chronic low back pain: what works? *Pain*. 2004;107(1–2):176–190. doi:10.1016/j.pain.2003.10.017
37. Koumantakis GA, Watson PJ, Oldham JA. Trunk muscle stabilization training plus general exercise versus general exercise only: randomized controlled trial of patients with recurrent low back pain. *Phys Ther*. 2005;85(3):209–225. doi:10.1093/ptj/85.3.209
38. Hayden JA, Van Tulder MW, Malmivaara AV, et al. Meta-analysis: exercise therapy for nonspecific low back pain. *Ann Internal Med*. 2005;142(9):765–775. doi:10.7326/0003-4819-142-9-200505030-00013
39. Hayden JA, Wilson MN, Stewart S, et al. Exercise treatment effect modifiers in persistent low back pain: an individual participant data meta-analysis of 3514 participants from 27 randomised controlled trials. *Br J Sports Med*. 2020;54(21):1277–1278. doi:10.1136/bjsports-2019-101205