Positional Release Technique vs. Cognitive Behavioral Therapy on Pain Intensity in Chronic Non-specific Low Back Pain: A Randomized Control Trail

Nosiba A. Fahmy*[1], Abeer M. Yamany[2], Rania R. Ali[2], Haidy S. Roshdy[2]

[1]*Department of Basic Science, Faculty of Physical Therapy, Horus University*
[2]*Department of Basic Science, Faculty of Physical Therapy, Cairo University*

KEYWORDS

COMBI method, Stunting, Pamekasan

ABSTRACT

Objectives: Chronic musculoskeletal pain is a challenging clinical concern, often causing significant patient distress. Accordingly, we aimed to assess and compare the efficiency of positional release technique (PRT) and cognitive behavioral therapy (CBT) in managing chronic non-specific low back pain (CNLBP). Methods: This study recruited 60 patients with pain duration exceeding three months from the Faculty of Physical Therapy Outpatient Clinic, Horus University, allocated randomly into Groups A, B, and C (n = 20) at 1:1:1, with all groups receiving conventional physical therapy (CT). Groups A and B followed PRT and CBT intervention, respectively, while Group C (Control) received only CT. Pain intensity (Primary outcome), pain pressure threshold (PPT), functional disability, lumbar range of motion, and cognition level were evaluated pre- and post-intervention using a Visual Analog Scale, algometer, Modified Oswestry Disability Index, inclinometers, and Pain Anxiety Stress Scale. Results: Post-treatment, all groups showed significant improvements in the assessed parameters, with Group A experiencing the most significant decrease in pain intensity and increase in PPT, while Group B showed a significant improvement in the disability index. Conclusions: Integrating either PRT or CBT with CT can effectively lower pain intensity and enhance back functionality in CNLBP patients.

1. Introduction

In a global context, low back pain (LBP) represents a frequent musculoskeletal disorder impacting 70%–80% of adults at some stage in their lives. LBP is recognized as a major contributor to job absenteeism and disability, besides being among the top five diagnoses in primary care settings [1, 2]. The aging and gradual population growth contribute to increased LBP-related disabilities, imposing a substantial socioeconomic burden on healthcare systems [3, 4]. Despite its prevalence, the specific etiology remains unclear in 85%–95% of cases, categorizing it as non-specific LBP (NSLBP) [5, 6]. Although most NSLBP episodes show significant improvement within the first six weeks, 40% of patients continue to have symptoms for more than three months, resulting in a chronic condition (CNLBP) [7].

Gaining a better comprehension of the CNLBP clinical course is important, as there is limited local research on its incidence and related risk factors. This knowledge is essential for addressing the disability associated with LBP. A personalized rehabilitation approach, considering patient-specific risk factors and the multidimensional nature of CNLBP, is necessary for effective management [8-11]. Several studies have highlighted the importance of enhancing the quality of care for both surgical and non-surgical approaches to managing LBP [3, 12, 13]. Nevertheless, physical therapists still face difficulties in following treatment guidelines that are in line with established standards [14, 15].

Current clinical practice guidelines for LBP have moved away from recommending surgical interventions and pharmacological treatments, including opioids [16-18]. On the other hand, they support using non-pharmacological interventions as the primary CNLBP therapeutic strategy to give patients the needed tools to manage their condition themselves [17, 18]. These guidelines promote active interventions to relieve pain, improve function, and reduce disability [16]. Many recommended interventions involve lifestyle changes, psychosocial strategies, and physical activity programs [17, 18]. Although CNLBP is prevalent and active treatments are widely supported, there is a dearth of comparative studies evaluating the efficacy of various lifestyle therapies for CNLBP.

The positional release technique (PRT) represents an indirect osteopathic therapy that entails positioning the afflicted tissue as well as dysfunctional joints and muscles in a comfortable position to minimize irritation, restore the normal functioning of the related tissue, and treat musculoskeletal and visceral malfunctions [19-22]. Initially known as "Spontaneous Release by Positioning" and later as "Strain and Counter Strain," this method has evolved into what is now collectively referred to as "positional release."

Cognitive behavioral therapy (CBT) is a psychological therapy commonly utilized in managing CNLBP. As a second-generation behavioral therapy, CBT is increasingly recognized in behavioral medicine. Physical therapists have adapted cognitive-behavioral strategies from evidence-based CBT programs with the primary goal of reducing pain and disability by decreasing fear of movement and enhancing self-efficacy [23-25]. The CBT has been revealed to positively impact patients having chronic LBP by improving disability and reducing pain catastrophizing, pre and post-treatment. The CBT emphasizes the importance of addressing negative thoughts and beliefs that are often associated with pain complaints. By helping patients reframe these negative cognitions into more realistic appraisals, CBT equips them with effective coping strategies to manage their pain [26, 27].

Our study hypothesized that there would be no significant differences between PRT and CBT in CNLBP patients, including pain intensity, pain pressure threshold (PPT), lumber range of motion (L-ROM), functional disability, and pain-related anxiety. Therefore, we aimed to identify the most efficient interventions for improving these parameters in CNLBP individuals.

2. Methodology

This study comprised 60 CNLBP patients from Horus University's Faculty of Physical Therapy Outpatient Clinic who were referred by orthopaedists to a prospective parallel randomized controlled trial. They were equally assigned at random into Groups A, B, and C (n = 20), with all groups receiving conventional physical therapy (CPT). Groups A and B followed PRT and CBT intervention, respectively, while Group C (Control) received only CPT. The included participants aged 20–35 years, had pain duration exceeding three months and up to two years, had a body mass index (BMI; BMI = weight/height2) of 18–30 kg/m², a cognitive score > 23 according to the Montreal Cognitive Assessment (MoCA) Scale, and normal vision and hearing. Exclusion criteria for participants included various conditions: Lumbar discogenic lesions, lumbar canal stenosis, lumbar spine infections, bony block in the lumbar region, lumbar surgery or trauma, any inflammatory arthritis, tumors, decreased ROM secondary to congenital anomalies, muscular contracture, previous cauda equina syndrome, psychological, cognitive, or emotional disturbances, or previous participation in CBT (Figure 1). This study used a computer software application (Microsoft Excel) to create a randomization table for simple randomization. The allocation ratio utilized was 1:1:1. Sequentially numbered opaque sealed envelopes were deployed to obscure the allocation sequence, ensuring that both the researcher and the participant remained unaware of the next assignment. The study assessed and compared data collected from all three groups before and after intervention: Pain intensity, PPT, functional disability, L-ROM, and pain-related anxiety. This study was authorized by the Faculty of Physical Therapy Ethical Committee, Cairo University

(P.T.REC/012/004617) and was registered on ClinicalTrials.gov (NCT06198660). The study followed the declaration of Helsinki, and its objectives and methods were thoroughly explained to all participants who signed informed consent. (Fig. 1).

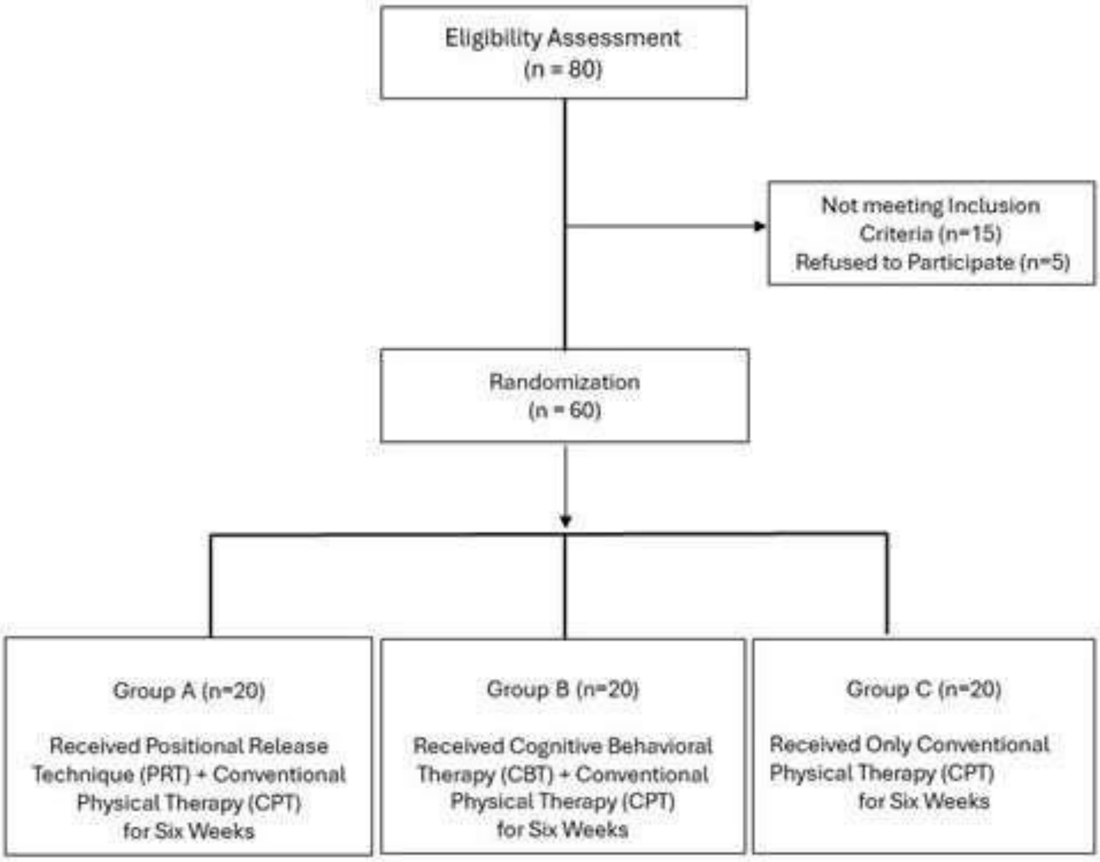

Fig. 1. Study flowchart

Primary outcome

Pain intensity

The Visual Analogue Scale (VAS) was deployed to assess pain on a 0–10 graphic scale: 0 reflects no pain, and 10 indicates the most intense pain. After that, the distance starting from (0) was measured with a ruler, rounding the recorded number to the nearest value [28].

Secondary outcome

Pain Pressure Threshold (PPT)

Herein, we utilized an electronic pressure algometer (Algometer commander, JTech Medical, 4314 ZEVEX Park Line; Salt Lake City, UT 84123, aiming to measure PPT with a stimulation surface area of 1 cm2. The algometer was placed perpendicular to the tissue surface, and three consecutive readings were acquired at each location, with a 10-second interval of recovery between each application. During the algometric measurements, the participants were instructed to affirmatively describe the experience of pain, and pressure-induced pain was quantified as PPT (kg/ cm2). The same investigator, who was blinded to the patient's clinical data, performed all PPT measurements [29]. Participants were positioned in a prone posture on a plinth, indicating interspinous regions between spinal processes from L1 to L5 with a felt pen to identify the precise location for repetitive pressure application. The L5 trigger point was only selected, which was 3 cm away from the L5 on both left and right sides, and was then compared. Participants communicated verbally when the first sense of pain was detected, and the pressure was stopped. Following the baseline algometry measurements, the participants were shifted to a seated position without any rest, assuming a fully flexed lumbar position [30].

Disability Index

The ODI is a clinical assessment tool that gives a percentage score as a disability estimation to determine the functional disability level [31]. Total ODI score ranges from 0 (no disability) to 100 (maximum disability) [32]: 0–20 reflect "minimal disability," 20–40 reflect "moderate disability," 40–60 reflect "severe disability," 60– 0 reflect "housebound," and 80–100 reflect "bedbound."

Lumbar ROM

L-ROM was measured using dual inclinometers, a reliable pendulum-based goniometry system including a 360-degree scale protractor with a counter-weighted pointer kept consistently vertical:

Lumbar flexion: The patient was initially directed to assume an upright stance with their feet in touch with one another. Inclinometers were centered at S1 and T12 palpation sites and calibrated to a zero. The patient was directed to gradually initiate flexion towards the extreme of the range within the threshold of discomfort.

The lumbar extension protocol involved repeating flexion to have the patient extend back either fully or positioning one inclinometer in the middle of the L3 vertebra of the lumbar spine.

Side bending: One inclinometer was positioned on the sacrum, and the patient was directed to stand upright with their feet slightly apart and then slowly move to the side while making contact between their hand and ankle, within the pain threshold.

Pain-related anxiety

The Arabic PASS-20 Questionnaire was used to determine the cognition pain levels [33, 34]. Responders evaluate each item using a six-point scale that spans from 0 (never) to 5 (always). Total scores run from 0, indicating absence of pain anxiety, to 100, indicating intense pain anxiety.

Intervention Procedures

Positional release technique (Group A)

Group A received PRT for six weeks, three times/week. Besides CPT, PRT involves locating tender points in selected muscles indicated by the patients to be the most painful points in each muscle and finding a position of comfort for the patient. The objective was to attain a minimum of 70% decrease in tenderness by monitoring the tender point for 90 s while maintaining a comfortable position.

Quadratus lumborum muscle: The tender sites on the transverse processes sides from L1 to L5 were subjected to anterior and medial pressure. The patient was lying in a prone posture, with the table head elevated or a cushion inserted beneath the chest to enhance the sensation of comfort. The examiner situated themselves contralaterally to the tender point and extended their arm to grasp the ilium of the side that was afflicted. Their next instruction was to flex and abduct the hip on the same side to approximately 45°.

Iliopsoas muscle: The examination identified the tender spots in the anterior lumbar region along the psoas major muscle as it passes through the anterior inferior iliac spine. The patient adopted a supine posture while the examiner situated themselves contralaterally to the sensitive area. The patient exhibited a hip flexion of approximately 90°, succeeded by a rotation of 60° away from the area of tenderness. Subsequently, the feet were allowed to sink downward towards the floor, leading to lateral flexion away from the sensitive areas.

Piriformis muscle: About midway between the inferior lateral angle of the sacrum and the greater trochanter, the tender points were found in the belly of the piriformis muscle, where pressure was exerted. The patient assumed a prone posture while the examiner positioned themselves on the tender side point. With the knee flexed and firmly supported by the therapist's thigh, the leg on the same side was elevated off the table. To achieve exact position adjustment, the hip was flexed within the range of 60–90°, followed by abduction and rotation.

Iliotibial band: Medial pressure was exerted on the tender points identified adjacent to the iliotibial band on the thigh lateral side, precisely along the midaxillary line. The patient may be positioned either supine or prone. Contralaterally to the tender point, the examiner firmly grabbed the patient's leg and performed significant hip abduction with either internal or external rotation.

Cognitive behavioral therapy (Group B)

Group B received 18 CBT sessions three times/week/six weeks, with each session lasting approximately 60 min. CBT focuses on correcting misconceptions about disability and pain, teaching effective coping approaches, and building self-confidence by gradually increasing activity levels.

Initial Session: During the initial session, we conducted individual interviews to acquire comprehensive information about the participant's history of LBP and to identify any beliefs that may be hindering their progress. Throughout this session, three treatment goals were set collaboratively, with a focus on incorporating exercise or physical activity to manage LBP effectively. In addition, the concepts of baseline setting and pacing were introduced.

Sessions 2-6: The sessions emphasized the cognitive aspects of therapy and were delivered in a structured manner using a PowerPoint presentation that included diagrams, images, and text to alter the physiological response to pain. The therapist provided a clear explanation of the lumbar spine's "lumbar engine", the neurophysiological factors involved in pain, the patient's active role in therapy (e.g., motivation and coping), and the importance of maintaining good ergonomics.

Sessions 7-12: In these sessions, the concepts covered in the earlier sessions were reviewed, and the operant aspects of therapy were introduced. This phase ensured that the participant had assimilated the cognitive components of the therapy. By this point in the treatment, the operant techniques were expected to have significantly reduced the anticipated pain. Between sessions, the physiotherapist taught self-therapeutic approaches: Stretching and promoting lumbar spine mobility. Additional exercises to activate the deep lumbar musculature were demonstrated to encourage compliance with the home exercise program.

Sessions 13-18: The final phase focused on respondent aspects of therapy, including diaphragmatic breathing and relaxation, to provide patients with effective coping strategies and lower their focus on pain. These sessions ensured that patients fully understood the therapy concepts and encouraged them to ask questions to clarify any doubts.

Conventional physical treatment (Group C)

Group C received CPT that included Transcutaneous Electrical Nerve Stimulation (TENS) and therapeutic exercises. The TENS therapy was delivered using the Astar model 100A, which provided low-intensity/high-frequency stimulation at the pain site to produce a "strong but comfortable TENS paresthesia." The treatment parameters, such as intensity (50-80 mA), frequency (2-100 Hz), and impulse duration (0.05-0.25 ms), were adjusted according to the individual patient's tolerance [35]. In addition to TENS, therapeutic exercises were performed [36]: Mild stretching exercises lasting 30 s for the hamstring, calf muscles, and back muscles from a long position; strengthening exercises targeting the back muscles, bridging and active back extension, and abdominal muscles; sit-up exercise and posterior pelvic tilt. Each exercise was executed thrice during a session, with a 6-second hold duration.

Statistical analysis

The sample size was determined by referencing Ibraheem et al.'s study [37], which revealed a significant variance in pain levels among the three groups, with an effect size of 0.42. With a significance level of 0.05 and a statistical power of 80%, the sample size needed for each group was determined to be 20 patients, ensuring a balanced 1:1:1 ratio. The sample size was calculated through G*POWER (version 3.1.9.2; Universität Kiel, Germany). F-tests, specifically One-way ANOVA and MANOVA, were employed for this purpose.

The statistical analyses were performed through the SPSS software version 25 for Windows (IBM SPSS, Chicago, IL, USA). The ANOVA test was used for comparing subject characteristics across groups while using the Chi-squared test to analyze gender distribution. Moreover, we assessed the normality of data for all variables utilizing the Shapiro-Wilk test. A Levene's test was deployed to confirm variance homogeneity between the groups. Mixed MANOVA was performed for the assessment of within-group and between-group factor effects on the VAS, ODI, PPT, PASS, and lumber ROM. To account for potential Type I errors, post-hoc tests were conducted for subsequent multiple comparisons employing the Bonferroni correction. $P < 0.05$ was deemed statistically significant.

3. Result and Discussion

Subject characteristics

Tab. 1 demonstrates no significant disparities among groups in age, BMI, MoCA scores, or sex distribution ($p > 0.05$).

Tab. 1. Subject characteristics

	Group A	**Group B**	**Group C**	**p-value**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	
Age (years)	24.65 ± 2.03	25.05 ± 1.61	25.20 ± 1.15	0.26
BMI (kg/m²)	24.50 ± 1.91	25.40 ± 1.57	25.15 ± 1.31	0.19
MOCA	28.15 ± 1.73	27.40 ± 1.69	27.60 ± 1.67	0.36
Sex, n (%)				
Females	15 (75%)	14 (70%)	11 (55%)	0.38
Males	5 (25%)	6 (30%)	9 (45%)	

SD: Standard Deviation; p-value: Level of Significance

Treatment Impact on VAS, ODI, PPT, PASS, and Lumber ROM

The mixed MANOVA analysis showcased a significant interaction between treatment and time ($F = 20.01$, $p = 0.001$, $\eta^2 = 0.79$), with significant main effects of time ($F = 351.47$, $p = 0.001$, $\eta^2 = 0.98$) and treatment ($F = 6.12$, $p = 0.001$, $\eta^2 = 0.46$).

Within-Group Comparisons

A significant reduction in VAS, ODI, PPT, and PASS scores was found in all three groups post-treatment **($p < 0.01$, Table 2)**. Unlike pre-treatment, trunk ROM in flexion, extension, and right and left bending significantly increased post-treatment **($p < 0.001$, Table 3)**.

Between-Group Comparisons

Group A exhibited a significantly decreased VAS and increased PPT in contrast to both Groups B and C ($p < 0.01$). Meanwhile, VAS and PPT were significantly higher in Group B than in C ($p < 0.05$). The ODI was significantly reduced in Group B compared with both Groups A ($p < 0.05$) and C ($p < 0.001$), as well as in Group A in comparison to C ($p < 0.001$). PASS scores were significantly lower in Groups A and B than in C ($p < 0.01$), with no significant disparities between Groups A and B ($p > 0.05$). Lumber ROM did not significantly differ among the groups post-treatment **(p > 0.05, Tables 2–4).**

Tab. 2. Mean VAS, ODI, PPT, and PASS Pre- and Post-Treatment

	Group A	**Group B**	**Group C**
	Mean ± SD	Mean ± SD	Mean ± SD
VAS			
Pre-treatment	6.75 ± 0.72	6.45 ± 0.76	6.90 ± 0.85
Post-treatment	2.60 ± 0.60	3.50 ± 0.69	5.05 ± 0.75
MD (% change)	4.15 (61.48%)	2.95 (45.74%)	1.85 (26.81%)
95% CI	3.85: 4.44	2.66: 3.24	1.56: 2.14
p-value	0.001	0.001	0.001
ODI			
Pre-treatment	29.35 ± 5.60	29.85 ± 6.25	32.65 ± 7.34
Post-treatment	18.50 ± 4.53	14.80 ± 3.53	26.45 ± 4.95
MD (% change)	10.85 (36.97%)	15.05 (50.42%)	6.20 (18.99%)
95% CI	8.93: 12.76	13.13: 16.96	4.29: 8.12
p-value	0.001	0.001	0.001
Right PPT			
Pre-treatment	4.25 ± 1.07	3.60 ± 1.27	3.65 ± 0.88
Post-treatment	7.15 ± 1.04	5.60 ± 1.35	4.70 ± 0.86
MD (% change)	-2.90 (68.24%)	-2.00 (55.56%)	-1.05 (28.77%)
95% CI	-3.21: -2.59	-2.31: -1.69	-1.36: -0.74
p-value	0.001	0.001	0.001
Left PPT			
Pre-treatment	3.45 ± 0.88	3.30 ± 0.80	3.35 ± 1.09
Post-treatment	6.65 ± 1.23	5.55 ± 0.69	4.35 ± 1.14
MD (% change)	-3.20 (92.75%)	-2.25 (68.18%)	-1.00 (29.85%)
95% CI	-3.51: -2.89	-2.56: -1.94	-1.31: -0.69
p-value	0.001	0.001	0.001
PASS			
Pre-treatment	52.20 ± 13.93	57.65 ± 13.50	56.15 ± 15.19
Post-treatment	35.70 ± 15.29	32.60 ± 13.41	51.80 ± 15.37
MD (% change)	16.50 (31.61%)	25.05 (43.45%)	4.35 (7.75%)
95% CI	13.03: 19.97	21.57: 28.52	0.88: 7.82
p-value	0.001	0.001	0.01

SD: Standard Deviation; MD: Mean Difference; CI: Confidence Interval; p-value: Probability Value

Tab. 3. Mean Lumber ROM Pre- and Post-Treatment

	Group A	**Group B**	**Group C**
	Mean ± SD	Mean ± SD	Mean ± SD
Flexion			

Pre-treatment	49.00 ± 5.98	50.15 ± 6.88	48.00 ± 5.24
Post-treatment	53.30 ± 5.69	52.35 ± 8.08	50.15 ± 5.02
MD (% change)	-4.30 (8.78%)	-2.20 (4.39%)	-2.15 (4.48%)
95% CI	-5.49: -3.11	-3.39: -1.01	-3.34: -0.96
p-value	0.001	0.001	0.001
Extension			
Pre-treatment	18.90 ± 3.89	18.10 ± 3.85	17.25 ± 4.44
Post-treatment	21.05 ± 4.42	21.80 ± 3.72	19.90 ± 4.17
MD (% change)	-2.15 (11.38%)	-3.70 (20.44%)	-2.65 (15.36%)
95% CI	-2.81: -1.49	-4.36: -3.04	-3.31: -1.99
p-value	0.001	0.001	0.001
Right Bending			
Pre-treatment	27.00 ± 5.23	28.95 ± 4.41	27.40 ± 5.37
Post-treatment	31.40 ± 4.52	32.80 ± 4.01	30.75 ± 5.55
MD (% change)	-4.40 (16.30%)	-3.85 (13.30%)	-3.35 (12.23%)
95% CI	-5.69: -3.11	-5.13: -2.56	-4.63: -2.06
p-value	0.001	0.001	0.001
Left Bending			
Pre-treatment	27.85 ± 4.85	30.65 ± 4.42	29.55 ± 5.34
Post-treatment	32.60 ± 4.44	33.70 ± 4.22	32.35 ± 5.00
MD (% change)	-4.75 (17.06%)	-3.05 (9.95%)	-2.80 (9.48%)
95% CI	-6.27: -3.23	-4.57: -1.53	-4.32: -1.28
p-value	0.001	0.001	0.001

SD: Standard Deviation; MD: Mean Difference; CI: Confidence Interval; p-value: Probability Value

Tab. 4. Comparison Between Groups Post-Treatment

Outcome	Group A vs. B	Group A vs. C	Group B vs. C	η^2
VAS	MD = -0.9 (-1.43: -0.37) p = 0.001	MD = -2.45 (-2.98: -1.92) p = 0.001	MD = -1.55 (-2.08: -1.02) p = 0.001	0.69
ODI	MD = 3.7 (0.29: 7.11) p = 0.02	MD = -7.95 (-11.36: -4.54) p = 0.001	MD = -11.65 (-15.06: -8.24) p = 0.001	0.56
Right PPT (kg)	MD = 1.55 (0.69: 2.41) p = 0.001	MD = 2.45 (1.58: 3.31) p = 0.001	MD = 0.9 (0.04: 1.76) p = 0.03	0.47
Left PPT (kg)	MD = 1.1 (0.29: 1.91) p = 0.004	MD = 2.3 (1.49: 3.11) p = 0.001	MD = 1.2 (0.39: 2.01) p = 0.002	0.46
PASS	MD = 3.1 (-8.38: 14.58) p = 0.78	MD = -16.1 (-27.58: -4.62) p = 0.003	MD = -19.2 (-30.68: -7.73) p = 0.001	0.26
ROM (degrees)				
Flexion	MD = 0.95 (-4.04: 5.94) p = 0.88	MD = 3.15 (-1.84: 8.14) p = 0.27	MD = 2.2 (-2.79: 7.19) p = 0.52	0.04

Extension	MD = -0.75 (-3.95: 2.46) p = 0.83	MD = 1.15 (-2.05: 4.36) p = 0.65	MD = 1.9 (-1.31: 5.11) p = 0.32	0.03
Right Bending	MD = -1.4 (-5.09: 2.29) p = 0.62	MD = 0.65 (-3.04: 4.35) p = 0.90	MD = 2.05 (-1.64: 5.74) p = 0.36	0.03
Left Bending	MD = -1.1 (-4.66: 2.46) p = 0.73	MD = 0.25 (-3.31: 3.81) p = 0.98	MD = 1.35 (-2.21: 4.91) p = 0.62	0.02

MD: Mean Difference; CI: Confidence Interval; p-value: Probability Value; η^2: Partial Eta Squar

Discussion

The current study offered valuable perspectives into the efficacy of various treatment modalities for CNLBP: PRT, CBT, and CPT on pain intensity, PPT, L-ROM, functional disability, and pain-related anxiety. The study found that PRT (Group A) significantly reduced VAS scores compared to CPT(Group B). This suggests that PRT is effective in alleviating pain. Additionally, Group A exhibited a significantly improved PPT compared to Group C, indicating that PRT not only reduces pain but also increases the tolerance to pain pressure.

Interestingly, Group B demonstrated a significant reduction in ODI scores compared to Group A and significant increases in right and left PPT in contrast to Groups A and C. This suggests that CPT may be more efficient in improving functional disability and enhancing pain threshold, unlike PRT alone. However, Groups A and B displayed significantly reduced PASS scores compared to Group C. This highlights that both PRT and CPT were more effective in improving functional status compared to CPT alone. The L-ROM for flexion, extension, and side bending did not significantly differ across the groups, suggesting that while PRT and CPT are beneficial for pain relief and functional improvement, their effects on ROM might be limited.

The positive impact of PRT on pain and functional outcomes aligns with the mechanism proposed in existing literature. PRT is known to relieve pain by reducing muscle contraction through a signaling mechanism to the brain, which addresses acute and delicate somatic dysfunctions[22, 38]. Our results come in agreement with prior studies reporting improvements in ROM, functional status, and pain reduction following PRT intervention[39].

Research comparing muscle energy approaches with Strain Counterstrain (SCS) or assessing SCS in combination with other techniques further substantiates the current findings. These trials have continuously elucidated the positive impacts of PRT on pain, function, and L-ROM[40]. Ali et al.[41] demonstrated that PRT was more effective than traditional therapeutic exercises in improving L-ROM and functional status, though pain reduction was not significantly different. The discrepancy regarding pain reduction could be due to variations in study protocols and treatment modalities.

Owen et al.[40] found that while SCS techniques effectively reduced pain, combining them with exercise therapy produced slightly different outcomes. This is in line with our study’s finding that combining McKenzie therapy with SCS was as effective as McKenzie therapy alone in symptom relief.

CBT was effective in improving functional outcomes, lowering pain, and addressing disability. The therapy works by reshaping patients' beliefs and attitudes about their pain, decreasing fear-avoidance behavior, and enhancing self-reported function[42]. Our results come in agreement with a systematic review indicating that CBT provides short-term benefits in pain and disability, though the long-term benefits remain mixed[43, 44]. Notably, CBT significantly improved functional disability and pain intensity, supporting its role in managing CNLBP.

The effectiveness of CBT in comparison to other therapies has been well-documented. Studies suggest that CBT is particularly beneficial when compared to usual-care controls, though benefits may be less pronounced in such comparisons[44]. CBT addresses cognitive and emotional aspects of pain, which can influence behavior and reinforce attitudes or beliefs[45]. This concept is integral to the success of CBT in pain management and reflects its application in multidisciplinary pain treatment programs.

Group C, which received CPT, showed less significant improvement compared to Groups A and B. Nevertheless, CPT still contributed to reductions in disability and improvements in ROM. Dynamic exercises targeting the back and abdomen, alongside stretching exercises, proved efficient in lowering functional disability and enhancing multifidus muscle strength[46, 47]. This supports the role of CPT in managing CNLBP, although it appears to be less effective than PRT or CBT in some aspects.

This study is limited to the absence of follow-ups, limiting the ability to ascertain the long-term sustainability of the observed intervention effects. Additional investigationd should integrate long-term follow-up to present a more in-depth comprehension of the durability of treatment outcomes.

To enhance CNLBP management, it is recommended that clinical practice adopt a multimodal approach, combining PRT and CBT to address its physical and psychological aspects. Personalized interventions tailored to individual patient needs, including pain severity, disability level, and psychosocial factors, are crucial for optimizing outcomes and patient satisfaction. Incorporating long-term follow-up will offer insights into the sustainability of intervention effects, guiding the development of strategies for ongoing management. Future research should explore the synergistic effects of combining various therapies and investigate the underlying mechanisms of PRT and CBT to refine treatment protocols. Broadening participant demographics in studies will ensure that findings are applicable to diverse patient populations. Advances in technology, such as wearable devices and telemedicine, could improve monitoring and adherence to treatment, offering new insights into efficacy and outcomes. Enhanced training for healthcare professionals on multimodal and personalized approaches, along with patient-centered research, will contribute to more effective and relevant treatment strategies. Lastly, exploring new therapies and conducting long-term impact studies will further advance the understanding and management of CNLBP, ultimately improving patient outcomes and quality of life

4. Conclusion and future scope

The PRT significantly improved pain intensity and PPT, making it an effective treatment modality for CNLBP. Here, CBT demonstrated notable enhancements in functional disability and pain intensity, highlighting its role in the multidisciplinary management of CNLBP. Given the complexity of chronic pain, a combined approach incorporating PRT and CBT is recommended for optimal management, as it addresses CNLBP's physical and psychological aspects.

Conflicts of interest

No conflict of interest.

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