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# Superficial back line release versus trigger points release in chronic nonspecific low back pain patients

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## ABSTRACT

The aim of this study was to investigate the effect of Superficial back line (SBL) release on pain, Pressure Pain Threshold (PPT), lumbar function, lumbar ROM, and balance in chronic nonspecific low back pain (CNSLBP) patients. Additionally, it aims to compare the effect of SBL release versus myofascial trigger points (MTrPs) release on the same variables. This was a Randomized Controlled Trial (RCT) involving forty-eight male and female patients with CNSLBP. They were randomized via an online randomization web service into 3 groups: group A (n=16) received SBL release and exercises, group B (n=16) received MTrPs release and exercises, while group C (n=16) received exercises only. There were statistically significant improvements in all outcomes post-treatment in comparison to pre-treatment within the three groups ($p<0.05$). After treatment, significant differences emerged between the groups in pain, PPT, lumbar extension ROM, and left anterior balance ($p < 0.05$). Group A showed the most favorable results in pain reduction, lumbar extension ROM, and left anterior balance compared to groups B and C, while Group B demonstrated the most favorable results in PPT compared to groups A and C. In conclusion, SBL release and MTrPs release are effective in improving pain, lumbar function, MTrPs PPT, lumbar ROM, and balance in patients with

CNSLBP. SBL release is particularly effective for pain, lumbar extension ROM, and left anterior balance, while MTrPs release is most effective for improving PPT.

**KEYWORDS**

Superficial Back Line Release; Trigger Points Release; Chronic Nonspecific Low Back Pain; Patients

## 1. INTRODUCTION

Chronic Low Back Pain (CLBP) is one of the most prevalent health concerns, affecting a large portion of the population (Jacobson et al., 2015). In fact, almost every individual is likely to experience Low Back Pain (LBP) at least once in their lifetime (Schmidt & Kohlmann, 2007). About 90% of all LBP instances are classified as Non-Specific Low Back Pain (NSLBP) (Natour et al., 2015). NSLBP is identified as pain persisting for over three months, without a clear connection to any identifiable specific pathology, such as an infection, tumor, osteoporosis, lumbar spine fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome (Balague et al., 2012).

As the second leading cause of disability, CLBP has significant impacts on absenteeism (Hartvigsen et al., 2018). It is also the second most common reason for outpatient visits. The restrictions that LBP places on the occupational and functional activities of patients have profound impacts on society and the economy, emphasizing the need for an effective treatment (Lee et al., 2011).

Research has found that patients with Chronic Non-Specific Low Back Pain (CNSLBP) have an imbalance in fascial tension (Hodges et al., 2003, 2005; Barker et al., 2006), which could be attributed to muscle imbalances in the back or lower limbs. Furthermore, this tension imbalance can affect muscle function due to tightness and/or adhesion in the myofascial system (Hides et al., 2008, 2009).

In individuals suffering from chronic low back pain (CLBP), there exists an observable augmentation in the thickness of both the superficial and deep thoracolumbar fascia (TLF), potentially impeding the coordinated movement between the underlying connective tissues of the back. This phenomenon was identified by Langevin et al. (2009). Furthermore, it has been established by Shum et al. (2005) that CLBP is accompanied by diminished mobility in the lumbar spine and hips, possibly attributed to escalated muscular tension surrounding the vertebrae, as suggested by Hamaoui et al. (2004).

Moreover, patients with CNSLBP can develop muscular trigger points in their lumbar muscles, which can cause back pain (Tak et al., 2013). The combination of reduced mobility, pain, muscle tightness, and adaptations in LBP can lead to decreased quality of life, activities of daily living, and functional disability (Avrahami & Potvin, 2014; Cox et al., 2000).

Furthermore to the presence of muscle tightness, individuals experiencing low back pain (LBP) have exhibited deficiencies in balance and proprioception, potentially stemming from muscle weakness (Della Volpe et al., 2006; Henry et al., 2006). Furthermore, atypical alterations in postural control have been detected among these patients (Karimi et al., 2008). As the musculature within the human body is interconnected through an extensive network of myofascial lines, it is plausible that these interconnections contribute to the perception of pain and the development of disorders that manifest in remote anatomical structures (Wilke et al., 2016). Fascia, the connective tissue, can distribute strain, tension, and mechanical forces to nearby skeletal muscles (Fousekis et al., 2019).

Myofascial Release (MFR) has gained popularity as a treatment for musculoskeletal disorders (Engel et al., 2014; lasPeñas et al., 2005; Ndetan et al., 2012; Ong et al., 2004; Wardle et al., 2013). By unwinding fascial restrictions, MFR enhances local circulation, stimulates the lymphatic system, and increases the flexibility, extensibility, and range of motion of stiff joints (Tozzi et al., 2012; Balasubramaniam et al., 2013). It can also help realign connective tissue fibers into a more functional and flexible arrangement (Shah & Bhalara, 2012). One study demonstrated that MFR treatment after repetitive strain injury resulted in normalized cell apoptosis rates, changes in cell morphology, and reorientation of fibroblasts (Meltzer et al., 2010).

The Superficial Back Line (SBL) is suggested to be the myofascial line most associated with lumbar pain (Myers, 2009; Myers et al., 2014). SBL release has been found to be effective in mitigating LBP (Wilke et al., 2016). It's been discovered that releasing tension in the upper parts of the SBL improves flexibility in the hamstrings, located in its lower parts (Fousekis et al., 2019). Releasing tension in the plantar aspect of the foot (part of the lower SBL) resulted in increased flexibility and range of motion in the hamstring, lumbar spine, and posterior muscles of the SBL (Grieve et al., 2015). Releasing tension in the hamstrings (a part of the SBL) resulted in improved cervical spine range of motion and balance (Hyong & Kang, 2013).

Manual Pressure Release (MPR) of muscular trigger points has proven effective in alleviating pain, enhancing physical function, and increasing the flexibility of back muscles in CNSLBP patients, leading to its use in treating CNSLBP (Dayanır et al., 2020). Despite the recent adoption of SBL release as a manual therapy treatment, a systematic review revealed a gap in research exploring its efficacy (Dhiman et al., 2021). Further studies are required to evaluate the effect of SBL release on CLBP patients (Richter et al., 2017; Wilke et al., 2016). Thus, the aim of this study is to investigate the impact of SBL release on pain, pressure pain threshold (PPT), lumbar function, range of motion, and balance in CNSLBP patients, comparing its effectiveness to the release of muscular trigger points on the same variables.

The aim of this study is to investigate the effect of SBL release on pain, PPT, lumbar ROM, function, and balance in CNSLBP patients. Additionally, it aims to compare the effect of SBL release versus MTrPs release on the same variables.

## 2. METHODS

### 2.1. Study Design and Participants

This study was a Randomized Controlled Trial (RCT) conducted at the physiotherapy outpatient clinics of AL Hayah University between December 2021 and March 2023. Forty-eight male and female patients with CNSLBP were recruited to participate in this study. Subjects were randomly allocated into three groups using the online randomization web service 'Research Randomizer' (https://www.randomizer.org/). Group A (n=16) received SBL release and exercises, Group B (n=16) received MTrPs release and exercises, and Group C (n=16) received exercises only.

All forty-eight patients were enrolled in this study based on the following inclusion criteria: prior to the commencement of the study, patients had reported experiencing LBP for a duration exceeding three months (Costa et al., 2008); the age of the participants ranged from 20 to 40 years.

Exclusion criteria were as follows: patients consuming analgesics for LBP during the study (Corrêa et al., 2015); individuals suffering from severe spinal pathologies, such as fractures, tumors, or inflammatory conditions like ankylosing spondylitis (Corrêa et al., 2015); patients exhibiting nerve root involvement, disk herniation, spondylolisthesis with neurological symptoms, or constriction of the spinal canal (Corrêa et al., 2015); pregnant women (Corrêa et al., 2015); individuals diagnosed with cancer (Corrêa et al., 2015); those with lower limb injuries; individuals with a Body Mass Index (BMI) exceeding 35.

### 2.2. Randomization and allocation concealment

After all baseline criteria were met, the eligible subjects were randomly allocated to one of three groups: treatment group A, which received SBL release and exercises; treatment group B, which received MTrPs release and exercises; or control group C, which received exercises only. The online randomization web service 'Research Randomizer' was used for randomization. All patients were asked to sign a consent form. This study was approved by the ethical committee of the Faculty of Physical Therapy (P.T.REC/012/003702).

### 2.3. Assessment, instrumentations and procedures

#### 2.3.1. Pain assessment using the Arabic Numeric Pain Rating Scale (ANPRS)

The culturally adapted and validated Arabic version of NPRS, as developed by Alghadir et al. (2016), serves as a reliable tool for evaluating low back pain in Arabic-speaking patients across various Arabic nations. Patients can select the number which best characterizes their level of pain (Alghadir et al., 2016).

#### 2.3.2. Pressure pain threshold (PPT) using a Pressure Algometer (PA)

Algometry, an objective method for measuring tenderness in soft tissues, is recognized as an effective tool for evaluating trigger points (TrPs) (Antonaci et al., 1998) and has high reliability (Chesterson et al., 2007). The algometer’s tip was placed on the TrPs, and pressure was gradually increased. Patients were instructed to say 'stop' as soon as they felt pain, at which point the algometer was immediately withdrawn. The force value at that moment was displayed and recorded (Pelfort et al., 2015).

#### 2.3.3. Transparent grading sheet

This specific chart was employed to identify TrPs, ensuring that manual methods were precisely applied to the same target location throughout the therapeutic sessions (Gomaa et al., 2016).

### 2.3.4. MTrPs Examination

Diagnosis of MTrPs was executed in accordance with the guidelines laid out by Simons et al. (1999), which include: 1) identification of a perceptible taut band in a skeletal muscle; 2) detection of a sensitive spot within the taut band; and 3) observation of referred pain as a response to MTrPs compression. After examining MTrPs in all muscles, participants were prompted: “When each of these muscles is pressed, do you perceive any pain locally or in other areas (referred pain)? Please indicate whether the pain you feel in the other area mirrors any symptom you regularly suffer from.” Participants were then required to confirm whether the pain triggered by palpation echoed their usual symptom (familiar pain) or any other unfamiliar pain (Iglesias-González et al., 2013).

### 2.3.5. Lumbar ROM assessment using an inclinometer

Inclinometers are the instruments utilized for the objective quantification of spinal active range of motion (AROM) (Clarkson, 2013), with high levels of reliability and validity (Saur et al., 1996).

A pair of inclinometers was deployed to measure the flexion and extension ROM in the lumbar region (Clarkson, 2013). The initial stance for lumbar flexion: the patient stands with feet positioned shoulder-width apart. The initial stance for lumbar extension: the patient places hands on the iliac crests and towards the small of the back. The inclinometers are positioned and reset at zero at each initial position.

Patients are guided to keep their knees straight while performing the test movements. Inclinometer Placement: Upper: a mark 15 cm above the spinous process of S2. Lower: on the S2 spine. End position for lumbar flexion: The patient bends the trunk forward to the maximum limit of lumbar flexion. End position for lumbar extension: The patient bends the trunk backward to the maximum limit of lumbar extension. Upon reaching the end position for each motion, the therapist documents the angle measurements from both inclinometers.

The AROM for lumbar spine flexion or extension is determined by the difference between the readings of the 2 inclinometers at the end position for the measured motion (Clarkson, 2013).

### 2.3.6. Balance assessment using the Y Balance Test (YBT)

The Y-Balance Test (YBT) is a reliable and valid instrument to evaluate dynamic balance in young adults suffering from chronic low back pain (CLBP) (Alshehre et al., 2021). The measurement of the lower limb length (LLL) was performed from the anterior superior iliac spine to the medial malleolus with the patient in a supine position. Subsequently, patients are guided on how to carry out the YBT as per the methodology outlined by Plisky et al. (2009). The lower limb that was under examination was considered the stance limb, and the direction of reach was established in relation to the stance limb's orientation (Gribble et al., 2012).

The patients were asked to reach as far as possible with the foot of the non-stance leg and then return the foot back to its starting position, maintaining balance. Any trial was disregarded and repeated if the participant does any of the following: (1) lifts the foot of the stance leg from the ground or crosses the marked line, (2) makes contact with the floor with the foot of the non-stance leg, or (3) loses balance before returning the foot of the non-stance leg to the starting position.

For each direction, the reach distances collected from the three trials were averaged and then normalized to leg length using the formula: (reach distance/LL) x 100% (Plisky et al., 2009; Gorman et al., 2012).

#### 2.3.7. Lumbar function assessment using the Arabic version of Oswestry Disability Index (ODI)

The Oswestry Disability Index (ODI) is often referred to as the benchmark for evaluating functional outcomes related to low back pain (Davidson and Keating, 2002). The Arabic rendition of the Oswestry Disability Index (ODI) has been proven to be reliable and valid, making it applicable for other Arabic-speaking populations, particularly those in North Africa (Guermazi et al., 2005).

For each section's scoring, the highest attainable score is 5: if the first statement was selected, the section's score equals 0; if the final statement was selected, it equals 5. If all 10 sections were completed, the score was calculated as follows: If a section is left out or not applicable, the score was calculated by dividing 16 (the total score attained) by 45 (the total possible score), and then multiplying by 100 to get a percentage score of 35.5% (Davidson & Keating, 2002).

### 2.4. Intervention

A total of 48 patients were recruited into this study. Treatment Group (A) received SBL release and exercises, treatment Group (B) received MTrPs release and exercises and control Group (C) received exercises only. The patients took part in their respective treatment regimens twice a week for a duration of six weeks, totaling twelve sessions, all held at the clinic (Dayanır et al., 2020). Upon completion of their initial assessments, the patients commenced their respective treatment programs on that very day, in line with the individual patient's assignment.

### 2.4.1. SBL release technique

The SBL release commenced from the distal end moving towards the proximal parts as follows:

#### *2.4.1.1. The release of the foot and plantar fascia*

The patient took a standing position and drove a tennis ball deeply into the plantar fascia of one foot at a time, emphasizing slow, detailed motion over swift, vigorous one. The patient directed his weight towards different sections of the plantar surface, starting from the front of the heel extending out to the balls of all five toes, ensuring coverage of the entire area.

Any tight or painful spots were specifically sought after. The patient applied enough pressure to straddle the line between comfort and discomfort, and maintained the pressure on each point for at least 20 seconds. The complete exercise took a few minutes (averaging around two minutes). The same process was then repeated for the other foot (Myers, 2009).

#### *2.4.1.2. Distal hamstrings release*

The patient assumed a prone position, with his knee bent at a 90-degree angle. The foot was held between the therapist’s shoulder and chest to allow the hamstrings to unwind. The therapist then slid the fingers of both hands into the crease at the back of the knee, between the two portions of the hamstring muscles (medial & lateral), palms facing laterally. The therapist applied downward pressure with his fingers until resistance was encountered, and then gently maneuvered between these tendons (two on the medial side and one on the lateral side) in an attempt to separate them, moving upward along the lower third of the patient's thigh.

Upon sensing a release under his fingers, the therapist asked the patient to regain control of his leg. The therapist withdrew his support but kept his fingers in place, asking the patient to gradually lower his foot to the table while the therapist continued working between the two hamstring tendons. This allowed the patient to stretch both the hamstrings and the gastrocnemius in an eccentric contraction, thereby disentangling their distal ends from one another (Myers, 2009).

#### *2.4.1.3. Separating the hamstrings*

In the process of addressing tight hamstring muscles, the patient's position mirrored that of the preceding technique. The therapist inserted his fingers between the medial and lateral hamstrings where the binding was most severe (just above the juncture between the leg and thigh), employing the same methodology as in the previous technique. Meanwhile, the patient was instructed to gently rotate the leg inwards and outwards with the knee at a 90-degree angle. As the restricting fascia progressively loosened, the therapist's fingers were able to delve deeper toward the femur. The therapist pursued this process a few inches higher until the technique's limit was reached (Myers, 2009).

#### *2.4.1.4. Sacrotuberous ligament release*

The patient was positioned lying prone. The therapist positioned their thumbs on the lower lateral angle of the patient's sacrum, applying firm and steady pressure to draw the tissue downwards and laterally towards the ischial tuberosity. This pressure was maintained deep and consistent, avoiding abrupt or invasive actions (Myers, 2009).

#### *2.4.1.5. Erector spinae fascia release*

The patient was positioned seated on a chair lacking back support, while the therapist stood behind them. Placing his hands on both sides of the patient's back, starting from the junction of the cervical and thoracic spine, the therapist assessed the tension and mobility. The therapist then targeted the stiff or tensed areas, guiding the patient to explore movement or bending within that spinal segment.

As the patient commenced a forward roll with their chin slightly drawn in, the therapist positioned the back surface of their proximal phalanges (akin to a soft, open fist) on both sides of the spine to engage the fascia. As the patient continued to bend forward, the therapist moved down in sync, applying pressure downwards and outwards without pushing the patient further into flexion.

The therapist followed the fascial layer, aiming to reach the sacral fascia concurrently with the patient fully folding forward (chest to thigh). The therapist ensured the pressure was directed more down the back than forward (Myers, 2009).

#### *2.4.1.6. The sub occipital release*

The patient was positioned lying on their back while the therapist sat behind them. The patient's head was nestled in the therapist's hands, with the occiput (the back part of the skull) resting in the therapist's palms. This arrangement allowed the therapist's fingers to be entirely free.

The therapist then curled his fingers up underneath the occiput. Instead of pointing upwards towards the ceiling, the fingers were directed towards the therapist, delving into the deep muscles of the area. Consequently, the therapist's six fingertips were aligned along the bottom edge of the occiput (Myers, 2009).

*2.4.1.7. The scalp release*

The patient was asked to lie on their back, while the therapist took position sitting behind the patient. The therapist then proceeded to locate the core of the knot, guided by the patient's feedback for accurate positioning.

Gently employing the pads of his fingers, the therapist initiated slow, circular movements. This motion moved the skin over the underlying bone, until the therapist could perceive the scalp liberating itself from the skull beneath (Myers, 2009).

### 2.4.2. MTrPs release technique

Following the steps of palpation and location of MTrPs (Clay & Pounds, 2003), the technique for MTrPs release was implemented as the next phase. The pinpointing of MTrPs was achieved via patient feedback, assisted by algometric measurements and utilization of the transparent grading sheet.

*2.4.2.1. Ischemic compression technique (manual pressure release MPR)*

The process involved the therapist applying pressure, using the pad of their thumb, onto the patient's skin to make contact with the fascia. The MTrP was maintained between the therapist's index and middle fingers to prevent it from shifting sideways during the procedure (Alvarez and Rockwell, 2002).

Each MTrP was held under pressure for a duration ranging from 30 seconds to a full minute. The release of pressure happened under one of the following conditions: a noticeable reduction in tension within the MTrP, when the MTrP no longer elicited tenderness, or upon completion of the one-minute timeframe, depending on whichever event occurred first (Simons et al., 1999; Travell & Simons, 1983).

### 2.4.3. Exercises

Every patient underwent a consistent exercise regimen spanning 12 sessions (twice a week over a six-week period). The routine incorporated exercises such as straight leg raises, bridging movements, recumbent cycling exercises, prone hip extensions, and abdominal curl activities

(Dayanır et al., 2020). Each exercise was completed in three sets, with each set consisting of ten repetitions. A one-minute rest period was allowed between each set.

*2.4.3.1. Abdominal curl exercises*

The patient started in a supine or hook-lying position, maintaining a neutral position of the lumbar spine. Initiation of the exercise involved the patient executing the drawing-in maneuver under the guidance of the therapist. The complexity of the exercise was gradually increased. Initially, the patient was asked to lift the shoulders off the floor until the scapulae and upper back were no longer in contact with the plinth, while keeping the arms positioned horizontally. The next level of complexity involved the patient shifting the position of their arms from a horizontal orientation to being crossed over the chest. Subsequently, the position was altered to place the arms behind the head, followed by the final stage where the patient was tasked with holding a weight or medicine ball (Kisner et al., 2017).

*2.4.3.2. Straight leg raising exercises*

The initial position required the patient to have their legs extended. The patient was then asked to perform a posterior pelvic tilt, followed by flexing both hips while keeping the knees extended. (Kisner et al., 2017).

*2.4.3.3. Bridging Exercises*

In a hook-lying stance, the individual focused on preserving a balanced spinal alignment as they elevated and descended their pelvis, engaging in hip flexion and extension (Kisner et al., 2017). The bridge position was held for isometric stabilization. The method was incrementally intensified through sequential arm movements, incorporating hand-held weights, alternatingly lifting each foot, stepping in place, and knee extension with each leg raise.

### 2.5. Statistical Analysis

Sample size calculation was performed using G*POWER software (version 3.1.9.2), which estimated that a sample size of 48 patients would be sufficient to achieve 80% power at $\alpha = 0.05$ with an effect size of 0.5. The data were normally distributed and homogeneous in terms of variances. One-way ANOVA was used to compare demographics (except for sex, which was tested with the Chi-squared test) and outcomes among the three groups, with post hoc tests for further analysis.

Within-group differences were assessed using paired t-tests. The level of significance was set at $p < 0.05$. All statistical analyses were performed using SPSS (version 24).

## 3. RESULTS

### 3.1. Baseline characteristics

As Table 1 shows, there are no statistically significant differences between groups in baseline physical characteristics (p value > 0.05).

**Table 1.** Comparison of baseline characteristics between groups

| Variable | Groups | Mean (SD) | p value |
|---|---|---|---|
| **Age** | Group (A) | 29.8 (6.38) | 0.92 |
| | Group (B) | 29.8 (6.23) | |
| | Group (C) | 30.56 (5.53) | |
| **Weight (kg)** | Group (A) | 85.88 (16.1) | 0.97 |
| | Group (B) | 85.25 (17.36) | |
| | Group (C) | 84.48 (15.27) | |
| **Height (m)** | Group (A) | 1.71 (0.107) | 0.94 |
| | Group (B) | 1.71 (0.105) | |
| | Group (C) | 1.7 (0.096) | |
| **BMI (kg/m$^2$)** | Group (A) | 29.11 (2.29) | 0.91 |
| | Group (B) | 28.74 (2.48) | |
| | Group (C) | 28.98 (2.2) | |
| **Sex distribution (male/female)** | Group (A) | 8/8 | 0.78 |
| | Group (B) | 7/9 | |
| | Group (C) | 9/7 | |

*Note: p value: Probability value; BMI: Body mass index; SD: Standard deviation*

### 3.2. Outcomes

Means and standard deviations of all outcomes (pain, PPT, lumbar ROM (flexion and extension), function, balance scores) pre- and post-treatment for the three groups are presented in Table (2).

#### 3.2.1. Within-Group differences

There are statistically significant improvements in all outcomes post-treatment in comparison to pre-treatment within the three groups (p-value<0.001) (Table 2).

**Table 2.** Within-group differences in pain, PPT, lumbar ROM (flexion an extension), function, and balance scores for the three groups

| Variable | Groups | Pre-treatment | | Post-treatment | | p value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| **Pain** | **Group (A)** | 6.75 | 2.18 | 1.63 | 1.2 | 0.000* |
| | **Group (B)** | 6.44 | 2.48 | 3.94 | 2.26 | 0.000* |
| | **Group (C)** | 6.44 | 2.48 | 4.13 | 2.16 | 0.000* |
| **Pressure pain threshold (PPT)** | **Group (A)** | 2.52 | 0.63 | 2.71 | 0.68 | 0.029* |
| | **Group (B)** | 2.28 | 0.57 | 4.52 | 1.13 | 0.000* |
| | **Group (C)** | 2.3 | 0.57 | 2.59 | 0.65 | 0.029* |
| **Flexion** | **Group (A)** | 38.75 | 8.66 | 53.31 | 5.74 | 0.000* |
| | **Group (B)** | 41.88 | 9.64 | 51.25 | 7.416 | 0.000* |
| | **Group (C)** | 41.88 | 9.64 | 49.38 | 8.54 | 0.000* |
| **Extension** | **Group (A)** | 9.94 | 5.46 | 24.25 | 3.28 | 0.000* |
| | **Group (B)** | 10.25 | 5.78 | 19.63 | 3.52 | 0.000* |
| | **Group (C)** | 11 | 4.65 | 17.88 | 3.54 | 0.000* |
| **Function** | **Group (A)** | 66.13 | 17.12 | 26.13 | 16.4 | 0.000* |
| | **Group (B)** | 53.88 | 21.07 | 34.25 | 19.22 | 0.000* |
| | **Group (C)** | 58.13 | 23.59 | 38.5 | 18.92 | 0.000* |
| **Right anterior balance** | **Group (A)** | 58.96 | 6.33 | 68.93 | 7.30 | 0.000* |
| | **Group (B)** | 58.09 | 6.88 | 62.57 | 7.71 | 0.000* |
| | **Group (C)** | 59.40 | 6.95 | 64 | 7.79 | 0.000* |
| **Right posterolateral balance** | **Group (A)** | 66.88 | 8.96 | 77.97 | 8.08 | 0.000* |
| | **Group (B)** | 64.69 | 9.02 | 71.38 | 9.23 | 0.000* |
| | **Group (C)** | 65.17 | 8.87 | 71.87 | 9.08 | 0.000* |
| **Right posteromedial balance** | **Group (A)** | 68.36 | 7.64 | 76.29 | 7.99 | 0.000* |
| | **Group (B)** | 67.92 | 7.82 | 71.90 | 7.23 | 0.000* |
| | **Group (C)** | 68.01 | 7.81 | 72.18 | 7.62 | 0.000* |
| **Left anterior balance** | **Group (A)** | 59.06 | 7.91 | 68.98 | 7.73 | 0.000* |
| | **Group (B)** | 58.68 | 6.813 | 63.26 | 7.01 | 0.000* |
| | **Group (C)** | 58.67 | 5.8 | 63.08 | 5.6 | 0.000* |
| **Left posterolateral balance** | **Group (A)** | 65.38 | 8.1 | 76.05 | 7.94 | 0.000* |
| | **Group (B)** | 64.06 | 7.77 | 70.58 | 7.65 | 0.000* |
| | **Group (C)** | 64.99 | 7.57 | 71.42 | 8.4 | 0.000* |
| **Left posteromedial balance** | **Group (A)** | 67.93 | 6.98 | 75.81 | 7.38 | 0.000* |
| | **Group (B)** | 67.44 | 7.68 | 71.46 | 7.65 | 0.000* |
| | **Group (C)** | 67.44 | 6.65 | 71.48 | 6.83 | 0.000* |

*Note: SD: Standard deviation; p value: Probability value*

### 3.2.2. Between-Group differences

There were no statistically significant differences between groups in any outcomes before treatment ($p > 0.05$). However, post-treatment, there were statistically significant differences between groups in pain, pressure pain threshold (PPT), lumbar extension ROM, and left anterior balance ($p < 0.05$). Group A exhibited the most favorable outcomes in pain reduction, lumbar extension ROM, and left anterior balance scores, although it showed less improvement in PPT compared to Group B. Overall, Group B demonstrated superior results in PPT but fell short in pain reduction, lumbar extension ROM, and left anterior balance improvement compared to Group A. No statistically significant differences were found between groups in lumbar flexion ROM and function post-treatment (p > 0.05) (Table 3).

**Table 3.** Between-group differences in pain, PPT, lumbar ROM (flexion and extension), function, and balance scores for the three groups

| Variable | Groups | Pre-treatment | | Post-treatment | |
|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD |
| **Pain** | **Group (A)** | 6.75 | 2.18 | 1.63 | 1.2 |
| | **Group (B)** | 6.44 | 2.48 | 3.94 | 2.26 |
| | **Group (C)** | 6.44 | 2.48 | 4.13 | 2.16 |
| | **F-value (P-value)** | 0.09 (0.91) | | 8.3 (0.01*) | |
| **Pressure pain threshold** | **Group (A)** | 2.52 | 0.63 | 2.71 | 0.68 |
| | **Group (B)** | 2.28 | 0.57 | 4.52 | 1.13 |
| | **Group (C)** | 2.3 | 0.57 | 2.59 | 0.65 |
| | **F-value (P-value)** | 0.09 (0.91) | | 41.6 (0.000*) | |
| **Lumbar Flexion** | **Group (A)** | 38.75 | 8.66 | 53.31 | 5.74 |
| | **Group (B)** | 41.88 | 9.64 | 51.25 | 7.416 |
| | **Group (C)** | 41.88 | 9.64 | 49.38 | 8.54 |
| | **F-value (P-value)** | 0.56 (0.55) | | 1.16 (0.32) | |
| **Lumbar Extension** | **Group (A)** | 9.94 | 5.46 | 24.25 | 3.28 |
| | **Group (B)** | 10.25 | 5.78 | 19.63 | 3.52 |
| | **Group (C)** | 11 | 4.65 | 17.88 | 3.54 |
| | **F-value (P-value)** | 0.17 (0.85) | | 14.6 (0.000*) | |
| **Function** | **Group (A)** | 66.13 | 17.12 | 26.13 | 16.4 |
| | **Group (B)** | 53.88 | 21.07 | 34.25 | 19.22 |
| | **Group (C)** | 58.13 | 23.59 | 38.5 | 18.92 |
| | **F-value (P-value)** | 1.44 (0.25) | | 1.9 (0.16) | |
| **Right anterior balance** | **Group (A)** | 58.96 | 6.33 | 68.93 | 7.30 |
| | **Group (B)** | 58.09 | 6.88 | 62.57 | 7.71 |
| | **Group (C)** | 59.40 | 6.95 | 64 | 7.79 |
| | **F-value (P-value)** | 0.16 (0.86) | | 3.1 (0.056) | |
| **Right posterolateralbalance** | **Group (A)** | | | 77.97 | 8.08 |
| | **Group (B)** | 64.69 | 9.02 | 71.38 | 9.23 |
| | **Group (C)** | 65.17 | 8.87 | 71.87 | 9.08 |
| | **F-value (P-value)** | 0.27 (0.77) | | 2.8 (0.073) | |
| **Right posteromedialbalance** | **Group (A)** | 68.36 | 7.64 | 76.29 | 7.99 |
| | **Group (B)** | 67.92 | 7.82 | 71.90 | 7.23 |
| | **Group (C)** | 68.01 | 7.81 | 72.18 | 7.62 |
| | **P-value** | 0.014 (0.99) | | 1.7 (0.2) | |
| **Left anteriorbalanc** | **Group (A)** | 59.06 | 7.91 | 68.98 | 7.73 |
| | **Group (B)** | 58.68 | 6.813 | 63.26 | 7.01 |

| | | | | | |
|---|---|---|---|---|---|
| **e** | **Group (C)** | 58.67 | 5.8 | 63.08 | 5.6 |
| | **F-value (P-value)** | 0.017 (0.98) | | 3.85 (0.029) | |
| **Left posterolateralbalance** | **Group (A)** | 65.38 | 8.1 | 76.05 | 7.94 |
| | **Group (B)** | 64.06 | 7.77 | 70.58 | 7.65 |
| | **Group (C)** | 64.99 | 7.57 | 71.42 | 8.4 |
| | **F-value (P-value)** | 0.12 (0.89) | | 2.17 (0.13) | |
| **Left posteromedialbalance** | **Group (A)** | 67.93 | 6.98 | 75.81 | 7.38 |
| | **Group (B)** | 67.44 | 7.68 | 71.46 | 7.65 |
| | **Group (C)** | 67.44 | 6.65 | 71.48 | 6.83 |
| | **F-value (P-value)** | 0.025 (0.98) | | 1.88 (0.16) | |

*Note: p-value: Probability value*

### 3.2.3. Post hoc test for pain, PPT, lumbar extension ROM, and left anterior balance scores post-treatment

Pairwise comparisons for the significant ANOVAs (pain, PPT, lumbar extension ROM, and left anterior balance post-treatment) revealed that group A had lower pain scores than group B and C, group B had higher PPT scores than group A and C, group A had greater lumbar extension ROM than group B and C, and group A had higher left anterior balance scores than group C ($p<0.05$) (Table 4).

**Table 4.** Post hoc test results for pain, PPT, lumbar extension ROM, and left anterior balance scores post-treatment

| **Outcomes** | **Post-hoc tests** | | |
|---|---|---|---|
| | **A vs. B MD (P-value)** | **A vs. C MD(P-value)** | **B vs. C MD(P-value)** |
| **Pain** | -2.3 (0.004*) | -2.5 (0.002*) | -0.19 (0.96) |
| **PPT** | -9.47 (0.000*) | 0 (1) | 9.47 (0.000*) |
| **Lumbar extension ROM** | 4.63 (0.001*) | 6.38 (0.000*) | 1.75 (0.33) |
| **Left anterior balance** | 5.72 (0.057) | 5.9 (0.048*) | 0.18 (0.99) |

*Note: MD: Mean difference; p-value: Probability value; *: Significant*

## 4. DISCUSSION

The aim of this study was to investigate the effects of SBL release on lumbar pain, pressure pain threshold (PPT), range of motion (ROM), function, and balance, and to compare its efficacy with MTrPs release in patients with CNSLBP. There were no statistically significant differences between groups in any of the outcomes prior to treatment ($p > 0.05$). After treatment, significant differences emerged between the groups in pain, pressure pain threshold (PPT), lumbar extension ROM, and left anterior balance ($p < 0.05$). Group A showed the most favorable results in pain reduction, lumbar extension ROM, and left anterior balance. Conversely, Group A had less improvement in PPT compared to Group B. Group B, while demonstrating superior results in PPT, did not achieve the same level of improvement in pain reduction, lumbar extension ROM, and left anterior balance as Group A. No significant differences were observed between the groups in lumbar flexion ROM and function post-treatment ($p > 0.05$).

Despite the shortage in the literature concerning the effects of SBL release in CNSLBP, there is a growing evidence that SBL release has significant implications for pain, MTrPs PPT, lumbar ROM, lumbar function, and balance.

The alleviation of pain could potentially be attributed to the following reasons: the enhancement of vascular and lymphatic circulation by SBL release and MTrPs release (Harrison et al., 2000) accelerate the removal of waste products (Albright et al., 2001) and disrupt tissue stiffness (Stuart, 2013). This allows the myofascial tissue to stretch and relax, subsequently improving flexibility and diminishing pain (Shah & Bhalara, 2012). Furthermore, SBL release promotes venous return (Padberg et al., 2004), contributing to a notable reduction in edema and subsequent pain relief (Carpentier & Satger, 2009). Pain relief could also be connected to the stimulation of afferent pathways and the excitation of A delta fibers afferents, resulting in segmental pain modulation (Melzack & Wall, 1965) and the regulation through the activation of descending pain inhibitory systems (Le Bars et al., 1979).

The rise in MTrPs PPT could be linked to the following reasons: SBL release aids in restoring the muscle tone and relaxing the muscles (Albright et al., 2001). It also assists in modifying the scar tissue matrix (Gebhardt, 1994; Glomsrod et al., 2001) by reallocating internal fluids, breaking restrictive intermolecular cross-links, and extending collagenous tissue (Harrison et al., 1999).

Manual pressure on the fascia could decrease myofascial hypertonicity via activating a fibroblast response (Eagan et al., 2007). The relaxation of fascial constraints restores the optimal elasticity of surrounding myofascial structures and rebalances intra- and inter-visceral pressures (Tozzi et al., 2012). The pronounced improvement in MTrPs PPT was observed in the MTrPs release group, not in the SBL release group. This could potentially be because the MTrPs release technique directly targets the trigger point, thereby offering quicker and more effective results than the SBL release technique, which is applied on the myofascial line in its entirety.

The increase in lumbar ROM could potentially be linked to the following reasons: SBL release enhances vascular circulation, thus augmenting flexibility and ROM (Albright et al., 2001). Manual muscle release results in changes in muscular elastic properties, reduces fascial stiffness, relieves muscle tightness, and decreases muscle spasms (Willard et al., 2012). Various studies have shown that MFR can boost the elasticity of muscles, tendons, ligaments, and fascia by relieving tension in tight muscles or fascia (Hanten et al., 2000; Hou et al., 2002), while simultaneously enhancing blood flow and circulation to the soft tissues. This, in turn, improves flexibility and ROM (Macdonald et al., 2013; Schleip, 2003).

The enhancement in balance could be linked to the following reasons: SBL release aids in the release of the hamstring, pelvic, and spinal fascia, augmenting their flexibility, increasing the joints' ROM, and normalizing the force transmission to the hip joint, pelvis, and spine. This leads to better stabilization of pelvic and spinal muscles, consequently improving balance (Hyong and Kang, 2013).

The role of SBL in improving balance was corroborated by Hyong & Kim (2012), who provided data on the impact of forward head posture on the ankle joint ROM and balance through the transmission of tension along the SBL. The enhancement in function could be linked to the following reasons: Our hypothesis is that the enhancement in function could be attributed to the actual improvements in pain, PPT, ROM, and balance that were evidenced.

Whiteside (2020) backed our findings. In their research, the efficacy of a suboccipital release, a technique of SBL release, was examined on NSLBP patients. Those patients who received a suboccipital release experienced immediate LBP relief. It was inferred that SBL release is an effective tool for LBP treatment and offers more instant relief and mobility improvements for patients.

Our study results are aligned with those of Fousekis et al. (2019), who explored the effects of SBL release on hamstring flexibility. University students were randomly split into an SBL release group or control group. It was deduced that SBL release leads to a significant increase in hamstring flexibility.

Additionally, the results of our study are consistent with those of Williams & Selkow (2019). They examined the effects of MFR of the plantar surface of the foot and hamstrings (parts of the SBL) on hamstring flexibility. College students performed the release using a hamstring foam roller and a lacrosse ball on the plantar surface of the foot. They concluded that MFR of the plantar surface of the foot and hamstrings enhances the sit-and-reach distance as a result of improved hamstring flexibility. Our study results are also supported by Cabak et al. (2021), who investigated the impact of myofascial release (MFR) on fascial flexibility in young adults. Participants underwent MFR and were assessed before and after the intervention. The study found a significant increase in range of motion (ROM) following MFR, concluding that MFR effectively enhances flexibility and ROM. Further, Boff et al. (2020) investigated the effectiveness of MFR on CNSLBP patients. Patients were randomly assigned to the MFR group. The results demonstrated significant balance improvement after the MFR intervention. Additionally, it was proven that SBL release improves ROM (Degenhardt et al., 2018) in CNSLBP patients.

Further supporting our study, Tamartash et al. (2023) examined the effects of hamstring (a component of the SBL) fascial release in CNSLBP patients. Their findings indicated that patients who underwent hamstring fascial release experienced improvements in pain, flexibility, and range of motion (ROM), concluding that this intervention is effective for CNSLBP patients.

Similarly, an RCT conducted by Andersson et al. (1999) corroborated our findings by evaluating the impact of myofascial release (MFR) on low back pain (LBP) patients. They reported that the MFR group required significantly less medication and engaged in less physical therapy compared to the standard medical care group.

Doğancali & Subasi (2023) supported our findings by examining the efficacy of myofascial release (MFR) on CNSLBP patients. Their study, which involved random assignment of patients to receive MFR, concluded that MFR significantly reduces pain and improves function in CNSLBP patients. Our results are also consistent with those of Hyong & Kang (2013), who investigated the immediate effects of hamstring fascial release (an SBL release technique) on cervical spine range of motion (ROM) and stability. Their study, involving university students, highlighted the positive impact of hamstring fascial release on cervical spine ROM and balance. Similarly, Rodríguez-Huguet et al. (2018) assessed the effectiveness of MFR in patients with mechanical neck pain. Their study, which compared MFR with traditional exercises, provided evidence that MFR is an effective tool for reducing pain and improving pressure pain thresholds (PPTs) in patients with neck discomfort.

The findings of Ozsoy et al. (2019) also align with our results. Their study evaluated the effects of MFR on NSLBP patients and revealed that MFR, combined with exercises, led to improvements in pain, disability, flexibility, ROM, and functionality. They concluded that MFR combined with exercises is a more effective treatment for NSLBP compared to exercises alone. Our study is further supported by Tamartash & Bahrpeyma (2022), who investigated the effects of myofascial release (MFR) on the pelvic inclination angle in CNSLBP patients. Patients were randomly assigned to MFR groups, and the MFR treatment followed techniques similar to those used in our study. They observed a significant change in the pelvic inclination angle only in the MFR group, concluding that MFR has the potential to improve pelvic inclination in CNSLBP patients and could serve as an effective corrective posture treatment. Additionally, Mavajian et al. (2020) conducted a preliminary study assessing the immediate effects of MFR combined with core stability exercises (CSEs) on balance and pain in CNSLBP patients. They reported substantial improvements in pain and balance following a single session of MFR and CSEs, suggesting that this combination effectively enhances these outcomes in CNSLBP patients.

A study by Lee et al. (2019) also supports our findings. They examined the effects of MFR on trunk range of motion (ROM) and stability in CNSLBP patients, with patients assigned to either the MFR group or a control group. The MFR group showed significant improvements in trunk ROM and balance after treatment, reinforcing the beneficial effects of MFR on these aspects in CNSLBP patients. Furthermore, MFR has been shown to be effective for a range of conditions beyond CNSLBP. It has been reported to alleviate pain and improve quality of life in conditions such as tension headaches (Ajimsha, 2011), idiopathic scoliosis (LeBauer et al., 2008), Raynaud's phenomenon (Walton, 2008), and systemic sclerosis (Martin, 2009). Treatment with MFR for lateral epicondylitis (LE) may also help halt the degenerative process of the tendons, promoting healing and restoring tendon architecture (Meltzer et al., 2010).

## 5. CONCLUSIONS

In conclusion, SBL release and MTrP release are effective in improving pain, lumbar function, MTrPs PPT, lumbar ROM, and balance in patients with CNSLBP. When comparing SBL release to MTrPs release, SBL release is particularly more effective for pain reduction, enhancing lumbar extension ROM, and improving left anterior balance, whereas MTrPs release is more effective for improving PPT.

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## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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