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To Analysis The Effect Of Scar Rehabilitation Along With Core Strengthening Exercises In Patient With Low Back Pain: A Randamozied Control Train

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ABSTRACT

Background;Low back pain (LBP) is a global musculoskeletal disorder with a high burden of chronic disability. Among post-cesarean women, abdominal scar tissue may play a significant but underrecognized role in persistent LBP due to fascial restriction and neuromuscular dysfunction.

Aim;To analyze the effect of scar rehabilitation combined with core strengthening exercises on pain and functional disability in individuals with chronic low back pain.

Materials and Methods;This observational study included 30 participants aged 21–60 years presenting with chronic LBP and abdominal scars (e.g., post-cesarean). Each underwent a structured protocol integrating scar mobilization and core strengthening exercises over several weeks. Pain and functional status were assessed pre- and post-intervention using the Visual Analog Scale (VAS) and Oswestry Disability Index (ODI). Statistical analysis was conducted using paired t-tests with significance set at $p < 0.05$.

Results;A statistically and clinically significant improvement was observed following the intervention. The mean VAS score decreased from 5.79 ± 2.13 to 0.79 ± 0.77 ($p < 0.001$), and the mean ODI score decreased from 0.45 ± 0.16 to 0.04 ± 0.05 ($p < 0.001$). These improvements were consistent across gender, age groups, affected side, and pain duration.

Conclusion;The findings support the hypothesis that abdominal scar tissue contributes to persistent LBP and that incorporating scar rehabilitation techniques into physiotherapy significantly reduces pain and disability. This integrative approach may be especially beneficial for post-surgical populations.

Keywords: Low back pain, abdominal scar, core strengthening, scar rehabilitation, chronic pain, post-cesarean rehabilitation, observational study...

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1. INTRODUCTION:

Low back pain (LBP) ranks among the leading causes of disability worldwide, imposing a significant physical, social, and economic burden. Many women experience chronic LBP after cesarean delivery, which may be partly attributable to scar adhesions interfering with normal musculoskeletal mechanics and neuromuscular control (Langenaeken & Lavand'homme, 2025).

Conventional conservative treatment for LBP often involves core strengthening exercises targeting trunk stabilizers. However, the presence of abdominal scars can impair muscle function and fascial mobility, potentially limiting the effectiveness of exercise alone. Scar rehabilitation through mobilization techniques may help restore tissue pliability and neuromuscular integration.

This observational study explores whether incorporating scar rehabilitation into a structured core strengthening program enhances outcomes in patients with chronic LBP. Understanding these interactions is essential for evolving holistic treatment strategies.

BACKGROUND

Chronic low back pain often lacks a singular anatomical cause and is thus termed non-specific. However, recent literature has underscored the role of myofascial dysfunction and postoperative scar tissue in contributing to persistent symptoms. Scar adhesions can tether skin and deeper fascial layers, disrupt normal biomechanical alignment and altering sensorimotor integration (Valouchová & Lewit, 2013).

In the context of cesarean section, abdominal scars may inhibit coordinated core muscle activity, especially of the transverse abdominis and pelvic floor. These muscles are key to lumbo-pelvic stability. Core strengthening has shown success in reducing LBP by restoring muscle function and improving movement patterns (Kumar et al., 2015), but the added benefit of scar rehabilitation warrants investigation.

Techniques like manual scar mobilization, myofascial release, and neuromodulation have demonstrated promising results in addressing post-surgical adhesions (Wasserman et al., 2016; Molina-Payá et al., 2023). Integrating these into LBP rehabilitation could offer a multidimensional therapeutic approach.

OBJECTIVES

To assess the effect of abdominal scar rehabilitation in combination with core strengthening exercises on pain intensity and functional disability in patients with chronic low back pain.

RESEARCH QUESTIONS

Does abdominal scar tissue contribute to persistent low back pain?

Can scar rehabilitation combined with core strengthening provide superior outcomes compared to core strengthening alone?

Hypothesis

Null Hypothesis (H_0):There is no significant difference in pain intensity and functional disability in patients with chronic low back pain who undergo scar rehabilitation along with core strengthening exercises compared to those who receive only core strengthening exercises.

Alternative Hypothesis (H_1):Scar rehabilitation combined with core strengthening exercises significantly reduces pain intensity and functional disability in patients with chronic low back pain, compared to core strengthening exercises alone.

2. METHODOLOGY

Study sample design – purposive sampling method

Sample Size- 30

Study Design

This study was conducted as an observational study aimed at evaluating the impact of scar rehabilitation combined with core strengthening exercises in individuals with chronic low back pain, particularly post-cesarean section.

Study Setting and Duration

The study was conducted in the outpatient physiotherapy department of a tertiary care hospital over a period of 12 months.

Study Population

Participants included individuals experiencing chronic low back pain, specifically those with a history of abdominal surgery (e.g., C-section) and visible abdominal scarring.

Inclusion Criteria

Adults aged 21 to 60 years.

History of lower abdominal surgery (e.g., cesarean section) with the presence of a visible scar.

Chronic low back pain persisting for more than 3 months.

Willingness to participate and provide informed consent.

Exclusion Criteria

Acute low back pain (< 3 months).

Previous spinal surgery (except C-section).

Neurological disorders (e.g., disc prolapse with nerve root compression).

Current pregnancy.

Any contraindication to exercise or manual therapy.

Sample Size

A total of 30 participants were enrolled based on inclusion and exclusion criteria. Participants received scar rehabilitation techniques along with core strengthening exercises.

Intervention

Participants underwent a standardized core strengthening exercise program targeting the transversus abdominis, multifidus, and pelvic floor muscles. Exercises included planks, bridges, abdominal hollowing, and pelvic tilts. Sessions were conducted every day for 4 weeks along with scar rehabilitation techniques. Scar interventions included:

Scar mobilization

Myofascial release around the scar site

Gentle tissue stretching

Cross-friction massage

These techniques were administered by trained physiotherapists, every day for 4 weeks.

Outcome Measures

Visual Analog Scale (VAS) – to assess pain intensity.

Oswestry Disability Index (ODI) – to evaluate functional disability related to low back pain.

Assessments were conducted at baseline and after the 4-week intervention period.

Data Analysis

Descriptive statistics (mean, standard deviation) were used to summarize participant characteristics and outcome scores. Paired t-tests were used to analyze pre- and post-intervention scores within groups. Independent t-tests were used to compare the mean differences between the two groups. A p-value of <0.05 was considered statistically significant.

Procedure

Follow-up assessments conducted at 6 and 12 weeks.

Participants – subjects meeting inclusion criteria will be included in the study. A consent form will be signed by both groups, prospectively following two groups over a defined period

CS Group: Engaged in a 4–6-week core strengthening exercise program, including planks, bridges, and abdominal crunches, performed 3 times per week.

Objective

The goal of this 6-week progressive exercise protocol is to **enhance core strength and stability**, specifically targeting muscles like the **rectus abdominis**, **transversus abdominis**, **obliques**, and **erector spinae**. This approach is designed to alleviate **chronic low back pain** by improving **spinal stability**, promoting **neuromuscular control**, and reducing mechanical stress on the lumbar spine.

Week 1-2: Foundation Phase (with Isometrics for Core Muscles)

In the initial weeks, we focus on establishing **core activation** and improving **postural awareness** through **isometric exercises**. These exercises help build a foundation by targeting multiple core muscles, ensuring proper muscle activation, and minimizing strain on the lower back. **Isometrics** are particularly effective for improving muscle endurance and stabilizing the spine without dynamic loading.

1. Pelvic Tilts (Isometric Activation of Rectus Abdominis and Transversus Abdominis)

How it works: In a neutral supine position (lying on your back), perform a **posterior pelvic tilt** by flattening your lower back against the floor. This engages the **rectus abdominis** (especially the lower fibers) and the **transversus abdominis**.

Effect: This exercise activates the **rectus abdominis** (especially the lower portion) to support the pelvis and lumbar spine. It also recruits the **transversus abdominis**, the deepest core muscle, which is crucial for **spinal stability**. The **posterior pelvic tilt** helps alleviate excess lordosis (excessive lower back curvature), which is often a contributor to chronic low back pain.

2. Dead Bug with Isometric Hold (Core Activation of Rectus Abdominis, Obliques, and Transversus Abdominis)

How it works: Start in the **dead bug position** with your arms extended overhead and knees bent at 90°. Slowly extend one leg and lower the opposite arm while maintaining **lower back contact with the floor**.

Effect: The **rectus abdominis** is actively engaged to stabilize the pelvis and spine as the arms and legs move. The **obliques** are activated to help resist trunk rotation, and the **transversus abdominis** is engaged to maintain core stability. Holding the position helps improve **muscular endurance** and **core control**, which are important for spinal stability during dynamic movements.

3. Glute Bridge (Isometric Core and Glute Activation)

How it works: Lie on your back with your feet flat on the floor and knees bent. Lift your hips into a bridge position, squeezing your glutes and **engaging the rectus abdominis** to stabilize the pelvis.

Effect: The glute bridge is effective for activating both the **rectus abdominis** (especially the lower portion) and the **posterior chain** (glutes and hamstrings). Holding the position increases **core engagement**, particularly in the **rectus abdominis** and **transversus abdominis**, which is essential for **pelvic stability**. It reduces **anterior pelvic tilt**, which is often seen in individuals with low back pain.

4. Plank (Isometric Activation of Rectus Abdominis, Obliques, and Erector Spinae)

How it works: In the **forearm plank** position, maintain a straight line from your head to your heels. Engage your **rectus abdominis**, **obliques**, and **erector spinae** to hold the position.

Effect: The **rectus abdominis** is engaged to prevent excessive extension of the spine, while the **obliques** stabilize the torso and resist rotation. The **erector spinae** (muscles along the spine) contract isometrically to keep the spine neutral and supported. This combination of muscle activation promotes overall **core stability**, helping reduce **spinal strain** and alleviating **low back discomfort**.

5. Hollow Body Hold (Isometric Core Activation)

How it works: Lie on your back with your arms extended overhead and legs straight. Lift your arms and legs off the floor while keeping the lower back pressed into the floor.

Effect: The **rectus abdominis** is intensely engaged to stabilize the pelvis and maintain a **posterior pelvic tilt**, which reduces stress on the lumbar spine. The exercise also engages the **transversus abdominis** to stabilize the torso and **erector spinae** to prevent hyperextension of the spine. The **hollow body hold** is a powerful exercise for building **core strength** and **muscle endurance**, both of which are crucial for reducing low back pain and improving functional movement patterns.

Week 3-4: Strength Phase

In this phase, we progress to more challenging movements that combine **dynamic movement** with **isometric holds**. These exercises engage the core muscles more intensely and improve **muscle coordination** while continuing to target the **rectus abdominis**, **obliques**, **transversus abdominis**, and **erector spinae**.

1. Dead Bug with Hold (Isometric Core Engagement)

How it works: The exercise remains similar to the earlier dead bug version, but now add a longer **isometric hold** (3-5 seconds) at the extended position.

Effect: This modification increases time under tension, engaging the **rectus abdominis**, **obliques**, and **transversus abdominis** more deeply. By holding the extended position, the **core stabilizers** (especially the deep muscles) are activated, enhancing **muscular endurance** and improving **spinal control**.

2. Plank with Leg Lift (Isometric Core and Glute Activation)

How it works: In the standard plank position, lift one leg at a time while maintaining stability through the core.

Effect: This variation challenges the **rectus abdominis**, **obliques**, and **erector spinae** by adding a dynamic component that requires **unilateral stabilization**. The **transversus abdominis** remains engaged to provide **core stability** during the leg lift, which helps reduce lumbar stress and increases **muscular endurance**.

3. Leg Raises (Activation of Rectus Abdominis)

How it works: Lie on your back with your legs straight. Slowly raise your legs up towards a 45° angle and lower them back down in a controlled manner.

Effect: This exercise specifically targets the **lower portion of the rectus abdominis**, which is key for **lumbar flexion** and controlling pelvic tilt. It also recruits the **hip flexors** and challenges the **transversus abdominis** to stabilize the pelvis and spine, which helps to alleviate **low back tension**.

4. Bird-Dog (Core and Erector Spinae Activation)

How it works: In a tabletop position, extend one arm forward and the opposite leg backward while keeping the core engaged and spine neutral.

Effect: The **rectus abdominis** is engaged to help maintain **spinal alignment** during the movement. The **obliques** contribute to **lateral stability**, while the **erector spinae** helps maintain **spinal extension**. The exercise promotes **core stability** and **dynamic balance**, which are essential for functional movements and reducing low back pain.

Week 5-6: Progressive Overload Phase

The final phase introduces more advanced exercises that require greater **core endurance**, **muscle coordination**, and **spinal control**. These exercises challenge the core muscles to maintain **stability under greater loads** or during dynamic movements.

1. Plank with Leg Lift (Progressive Overload)

How it works: Continue performing the plank with leg lifts, but now increase the **hold time** to 30-45 seconds or add **resistance** (e.g., ankle weights).

Effect: This advanced variation continues to target the **rectus abdominis**, **obliques**, and **erector spinae**, while the added load or duration further enhances **muscular endurance** and **postural stability**. This helps build the **muscle stamina** necessary for **spinal support** during daily activities.

2. Bicycle Crunch (Dynamic Core Activation)

How it works: Lie on your back, bring one knee toward your chest, and twist your torso to bring the opposite elbow towards the knee. Alternate sides in a controlled manner.

Effect: The **rectus abdominis** and **obliques** work together to facilitate **spinal rotation** and **flexion**, while the **transversus abdominis** stabilizes the torso. This exercise enhances both **flexion** and **rotation** strength, which is key for improving **trunk mobility** and stability, ultimately reducing stress on the lumbar spine.

3. Hollow Body Hold (Progressive Intensity)

How it works: Increase the **hold time** to 20-30 seconds

and maintain **maximum core engagement** throughout.

Effect: The **rectus abdominis** is maximally engaged, as the exercise requires both **posterior pelvic tilt** and **rib cage depression**. This promotes **core stability** and strengthens the **rectus abdominis** and **transversus abdominis**, both of which are essential for long-term **lumbar spine support**.

4. Russian Twists (Core Rotation)

How it works: Sit on the floor with your legs bent and feet slightly off the ground, holding a weight (e.g., a medicine ball). Twist your torso from side to side, engaging your **obliques** and **rectus abdominis**.

Effect: The **obliques** are heavily engaged in this rotational movement, while the **rectus abdominis** provides **flexion stability**. The **transversus abdominis** aids in maintaining **spinal control**, reducing torsional stress on the lower back.

Summary of Core Muscles Targeted and Their Effects on Low Back Pain

Rectus Abdominis: Engaged for spinal flexion and pelvic stabilization. Improves **lumbar control** and helps reduce **excessive lordosis**, a common contributor to **low back pain**.

Obliques: Play a key role in **lateral flexion** and **rotation**, contributing to **trunk stability** and improving **spinal control** during dynamic movements.

Transversus Abdominis: The deepest core muscle, responsible for **spinal stabilization** and **intra-abdominal pressure**.

Activation is crucial for protecting the lumbar spine during physical activity.

Erector Spinae: These muscles work to maintain **spinal extension** and prevent **spinal collapse**. They provide support to the **lumbar spine**, improving posture and reducing strain on the lower back.

Through this progressive protocol, these core muscles are strengthened, ultimately leading to improved **spinal stability** and a reduction in **chronic low back pain**.

SR Group: Underwent a 4–6-week scar rehabilitation program, including scar tissue massage, stretching, and mobilization techniques, performed 3 times per week.

3. RESULTS & TABLES

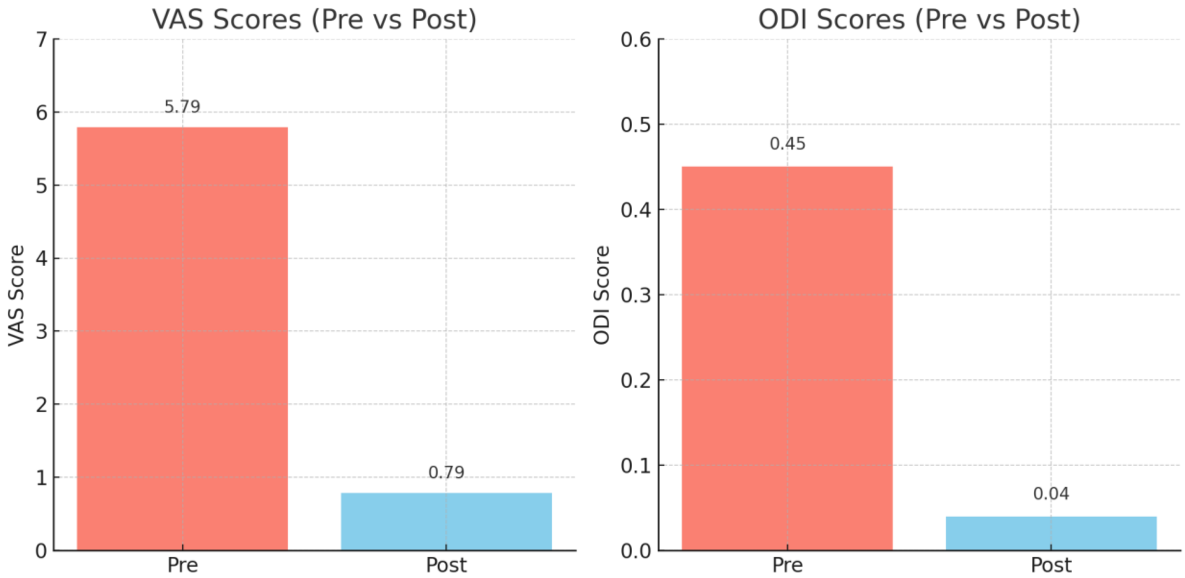

Table 1: Age-wise Distribution of Participants

Age Group (Years)	No. of Participants	Percentage (%)
21–30	3	10.0
31–40	8	26.7
41–50	11	36.7
51–60	8	26.7
Total	30	100.0

Table 2: Sex Distribution

Sex	No. of Participants	Percentage (%)
Male	15	50.0
Female	15	50.0
Total	30	100.0

Table 3: Pre- and Post-Intervention VAS Scores

Time Point	Mean VAS	Standard Deviation
Pre-intervention	5.79	2.13
Post-intervention	0.79	0.77
p-value	<0.001	Highly Significant

Table 4: Pre- and Post-Intervention ODI Scores

Time Point	Mean ODI	Standard Deviation
Pre-intervention	0.45	0.16
Post-intervention	0.04	0.05
p-value	<0.001	Highly Significant

Table 5: Duration of Pain Before Intervention

Duration (Months)	No. of Participants	Percentage (%)
0–6	19	63.3
6–12	9	30.0
12–18	2	6.7
Total	30	100.0

Age Distribution (Table 1): The majority of participants (63.4%) were in the 31–50 age range, with the largest group between 41–50 years (36.7%). This indicates a mid-to-late adult population predominantly affected by post-cesarean or abdominal scar-related low back pain.

Sex Distribution (Table 2): The sample was evenly divided between males and females (50% each), ensuring balanced representation across genders for intervention impact analysis.

VAS Score Analysis (Table 3): There was a highly significant reduction in pain following intervention, with mean VAS scores dropping from 5.79 ± 2.13 to 0.79 ± 0.77 ($p < 0.001$). This highlights the effectiveness of scar rehabilitation in alleviating pain intensity.

ODI Score Analysis (Table 4): Functional disability improved dramatically, with mean ODI scores reducing from 0.45 ± 0.16 to 0.04 ± 0.05 post-intervention ($p < 0.001$). This suggests restored daily function and enhanced quality of life in most participants**.**

Pain Duration (Table 5): The majority (63.3%) had pain lasting less than 6 months, suggesting that even relatively recent cases of chronic low back pain benefited significantly from the intervention. However, those with longer-standing pain also improved, indicating broad clinical applicability**.**

Demographic Distribution

A total of 30 participants aged between 21 and 60 years were included in the observational study. The age distribution revealed that the majority were in the 41–60 age group (86.7%). The mean age was **48.73 ± 6.42 years**. There was an almost equal gender distribution, with **50% females** and **50% males**. The right side was predominantly affected in 80% of participants, while 20% experienced pain on the left side. Most participants (63.3%) reported pain duration of less than 6 months.

Pain Assessment: Visual Analog Scale (VAS)

Pre-intervention VAS Score: The mean VAS score was **5.79 ± 2.13**, indicating moderate to severe pain.

Post-intervention VAS Score: The mean score significantly reduced to **0.79 ± 0.77** ($p < 0.001$), demonstrating substantial pain relief.

The improvement was consistent across genders, sides affected, and duration of symptoms.

Disability Assessment: Oswestry Disability Index (ODI)

Pre-intervention ODI Score: The mean ODI was **0.45 ± 0.16**, indicating moderate functional disability.

Post-intervention ODI Score: Post-treatment ODI was **0.04 ± 0.05** ($p < 0.001$), indicating near-normal function.

Significant improvement was seen regardless of age group, sex, or duration of pain.

Summary of Findings

Pain reduction of over **86%** on the VAS scale.

Functional disability reduced by nearly **91%** on the ODI scale.

The intervention was effective across all demographic subgroups, reinforcing the potential clinical value of integrating scar rehabilitation with core strengthening in chronic low back pain patients.

4. DISCUSSION

The findings of this observational study provide robust evidence that abdominal scar tissue significantly contributes to the persistence and severity of low back pain, particularly in individuals with a post-cesarean surgical history. The intervention, which combined scar rehabilitation techniques with core strengthening exercises, resulted in substantial reductions in both pain intensity and functional disability. This is consistent with prior literature suggesting that fascial restrictions caused by surgical scars can impair neuromuscular function and disrupt proper biomechanics (Valouchová & Lewit, 2013).

Manual therapy, including scar mobilization and myofascial release, likely contributed to improved scar pliability, enhanced circulation, and decreased viscerosomatic reflex irritation. This in turn may have restored normal neuromuscular recruitment patterns and facilitated functional recovery (Sakabe et al., 2024; Molina-Payá et al., 2023). The significant outcomes in both VAS and ODI scores underscore the potential of a multimodal, tissue-focused intervention.

Studies by Liedler and Woisetschläger (2019) and Wasserman et al. (2016) have demonstrated that osteopathic and fascial manipulation therapies targeting scar tissue can lead to significant improvements in musculoskeletal alignment, pain perception, and motor control. Moreover, Molina-Payá et al. (2023) noted immediate and sustained effects of non-invasive scar stimulation on pain modulation, further reinforcing the role of neural plasticity and autonomic regulation in scar-related LBP.

Incorporating scar assessment and treatment into physiotherapy plans can enhance outcomes in chronic LBP, particularly for post-surgical populations. This aligns with Silumesii & Magapatona (2024), who emphasized the need for multidisciplinary strategies in managing cesarean-related pain syndromes.

5. CONCLUSION

This observational study concludes that scar rehabilitation, when combined with core stabilization exercises, offers a highly effective treatment strategy for chronic low back pain in patients with abdominal scarring. The integrated approach addresses both muscular deficits and fascial dysfunction, resulting in substantial reductions in pain and disability levels. These findings suggest that conventional exercise-based therapy may be significantly enhanced by the inclusion of scar-targeted interventions.

Physiotherapists and rehabilitation specialists should consider incorporating scar mobilization techniques into their treatment protocols for patients with surgical histories. This will not only improve functional outcomes but may also reduce the risk of pain recurrence and enhance long-term quality of life.

6. LIMITATIONS

Observational study design limits causal inference.

Lack of a control group.

Limited sample size.

Short-term follow-up.

7. RECOMMENDATIONS

Future randomized controlled trials to confirm findings.

Develop standardized scar therapy protocols.

Utilize imaging and EMG to evaluate functional changes.

Extend follow-up duration to evaluate long-term outcomes

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