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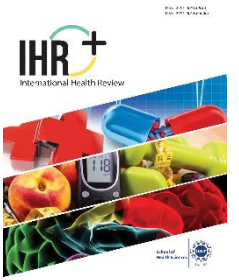

Title:	**Comparison of Scar Mobilization Techniques with and without Core Stability Exercises on Scar Tissue Mobility and Lumbopelvic Pain**
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Comparison of Scar Mobilization Techniques with and without Core Stability Exercises on Scar Tissue Mobility and Lumbopelvic Pain

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ABSTRACT

Abdominal adhesions and lumbopelvic pain can occur after a caesarean section. Many treatment approaches, such as injections, massage, surgical release, soft tissue release, strengthening, stretching and core stability exercises are available for abdominal scars. Physiotherapy treatments are considered safer and more convenient. The study aims to compare the effects of scar mobilization techniques with and without core stability exercises on scar tissue mobility and lumbopelvic pain. The study was a randomized clinical trial conducted at the Rafiqa Hospital and Fatima Hospital, Sargodha, Pakistan. A sample of 30 participants was allocated in Group A and B. Group A received scar mobilization and core stability exercises, while Group B received only scar mobilization, with both groups undergoing 3 sessions per week for total three weeks. The groups were assessed at baseline after the 5th and 9th sessions, using Oswestry Low Back Pain Disability Questionnaire (ODI), Numeric Pain Rating Scale (NPRS), Manual Scar Mobility Testing (MSMT), and Vancouver Scar Scale (VSS). Moreover, the data were analyzed using SPSS 25. The mean age of participants was 27.22 ± 4.21, and their body mass index was 27.10 ± 3.53. Both groups showed significant differences within the subject's scores of disability, pain and scar mobility (p<0.05). Between-group comparison of both groups at post-treatment II showed considerable improvement in pain scores (NPRS score, p<0.05). Whereas non-significant results were in other outcome measures (disability and scar mobility p>0.05) in post-treatment II. Scar mobilization techniques with core stability exercises were more effective than scar mobilization techniques alone in the conservative treatment of females with lumbopelvic and scar pain after caesarean section.

Keywords: cicatrix, exercise, hypertrophic, pelvic girdle pain, postpartum period

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1. INTRODUCTION

Caesarean deliveries have become increasingly common and preferred in the present era [1, 2] and count for almost 20% of all deliveries worldwide, with this rate continuously rising [3]. It affects the quality of life of women and results in long-term health problems. Various problems that the mothers have during or after pregnancy include pelvic girdle pain, pelvic floor prolapse, sexual dysfunction, urinary and faecal incontinence, musculoskeletal issues, and caesarean scar defects [3–6]. Many risk factors like maternal age, retroverted uterus, duration of labour, repeated caesarean sections, surgical technique used, postpartum haemorrhage and surgical site infections are all associated with the development of a caesarean scar defect [7]. Previous studies show that after a caesarean section, 50-60% of cases at six months and 26% at one-year post-surgery have scar pain [8]. Obese females have a 10% chance of developing caesarean site infection [9]. The incidence of abdominal adhesions and associated problems is higher in females with a history of caesarean delivery and limit the movement of abdominal muscles; hence, these factors should be guided well to the patients to avoid or mitigate complications [10, 11].

Various treatment approaches are available for the conservative and non-conservative treatment of caesarean scar defects, ranging from spontaneous resolution, injection administration and surgical release of the scar [12]. Physiotherapy treatments are also available for abdominal scars and adhesions related to abdominal surgery, like soft tissue mobilizations, scar mobilization, abdominal massage, and myofascial release [13, 14]. Progressive relaxation of the muscles and myofascial release of the tissues have been shown to reduce the pain and improve the patient's daily physical activities after a caesarean section [15, 16].

Low back pain (LBP) is a common condition among females during pregnancy that develops during the second trimester and remains through the end of pregnancy and sometimes even beyond [17, 18]. Lumbopelvic pain is due to postural changes and ligament laxity [19]. The lumbar spine supports the trunk and transfers the upper body's weight to the pelvis and lower limbs. Loading due to pregnancy-related weight gain makes the lower back more susceptible to pain [18]. Abdominal adhesions formed after the caesarean also play a role in patients' low back pain [3, 20].

Literature indicates that various physical therapy interventions have evidence-based results in reducing pain intensity in women with postpartum LBP. Multiple exercises like stabilization exercises, isometric and isotonic activities, dynamic neuromuscular stabilization, acupressure, pelvic floor exercise, manual therapy and relaxation exercises, etc., are beneficial for controlling back pain and improving the patient's functioning [21–24]. Core muscle strengthening exercises, which focus on strengthening the weak deep trunk musculature, are significant for pain reduction and muscle activity improvement [25, 26]. Scar mobilization techniques and core stability exercises for postpartum females are effective physiotherapy interventions for reducing post-operative scar complications and low back pain [4, 13, 16, 23].

The high prevalence of caesarean deliveries worldwide and its associated complications, have raised concerns among women's health practitioners to comprehensively manage females postpartum to alleviate their pain related to incision and lumbopelvic pain. The current study's findings can help physiotherapists in effectively managing caesarean incision scar pain and lumbopelvic pain post-surgery. This study can add valuable knowledge to provide patients with non-invasive and non-pharmacological options for managing both scar and lumbopelvic pain.

2. METHODOLOGY

This study was a randomized clinical trial, and the trial registration number is ClinicalTrials.govt ID: NCT05355181. This study was conducted at the Gynecological and Physiotherapy Department of Rafiqa Medical Centre and Fatima Hospital in Sargodha, Pakistan. The Institutional Review Committee of Riphah International University Islamabad (Lahore Campus), Pakistan, approved the study protocol with reference no. REC/RCR & AHS/22/0504. The sample size of n=30 was calculated by epitool software [25]. Non-probability convenience sampling technique was used to collect the data. Participants were women aged 20-40 years, at least six weeks postnatal, with completely healed scars (lower segment transverse incision technique) and reported no complications after the surgery were included in the study [13, 19].

The researcher excluded participants with an abdominal hernia, skin infections and diastasis recti abdominis. Once the above mentioned inclusion and exclusion criteria was fulfilled, only the eligible participants

were included in this study. Written informed consent was taken from each patient. Participants were randomized through the lottery method. Number 1 were allocated to Group A and number 2 to group B. The researcher randomized participants through the lottery method. Each participant was requested to draw either number 1 or number 2 from a box and the participants who selected the number 1 was allocated to Group A and those who drew number 2 were allocated to Group B. Group A was treated with scar mobilization techniques combined with core stability exercises, and Group B was with scar mobilization techniques only. The Group A was treated with scar mobilization techniques with core stability exercises, while Group B received only scar mobilization techniques. The researcher collected the baseline data on the 1st visit. The researcher provided the treatment according to the treatment plan for 3 weeks. Participants completed the questionnaires of MSMT, the VSS, NPRS and ODI. Treatment then continued according to the allocated groups. Patients were not blinded, and the same physiotherapist treated the patients. However, only the outcome assessor was blinded.

2.1. Common Treatment

Baseline treatment included an ultrasound (3MHz-0.10-1.5W/cm^2) applied to the scar site for 5 minutes and applying TENS (100 Hz frequency/ pulse width 75µs/ amplitude 10 to 30 mA) and a heating pad to the lower back. General mobilization exercises of the body and deep breathing during and between exercises were performed by both groups [27].

2.2. Scar Mobilization Technique

Scar mobilization techniques included the soft tissue mobilizations of the scar tissues. Participants were asked to lie supine on the couch and to expose the lower abdomen area. The fascia was moved in the transverse and longitudinal direction with the muscles to check the scar's adherence and promote healing. The scar was moved in the C and S shapes by the therapist's hands to enhance its mobility, and rolling and lifting were performed afterwards. Rolling checked the mobility of the scar in the left and right directions, whereas lifting evaluated the movement of the scar in cranial and caudal directions [13, 16, 28, 29].

2.3. Core Stabilization Technique

In the core stabilization exercises, patients were asked to lie supine and complete sets of single knee-to-chest on each side and both simultaneously.

Abdominal draw-ins and pelvic tilting were performed, and isometrics for gluteal and hip muscles were done. Hamstrings stretch, bridges and trunk rotations were also included. Cat and camel exercises were also part of the regimen. Additionally, pelvic floor muscle exercises were guided to the patients [4, 19, 21, 25, 26].

All participants received a total of 9 treatment sessions over three weeks, with three sessions scheduled on alternate days each week. The researcher reassessed the patients after the 5th and 9th visits. After treatment on the 5th and 9th visit, the patients were assessed on outcome measures.

The NPRS is a numeric scale in which 0 to 10 numbers are displayed horizontally, and the best number indicating pain intensity is selected. 0 means no pain, and 10 represents the worst possible pain [27]. The Oswestry Disability Index (also known as the Oswestry Low Back Pain Disability Questionnaire) is a tool that is used to measure a patient's permanent functional disability. The test has ten sections with five categories in each section; the total score is 50. All ten sections are completed, and the score is added in percentage [26]. In MSMT, the examiner evaluates the appearance and mobility of a healed scar [29]. The VSS evaluates four physical features: scar pigmentation, vascularity, pliability, and height. It has an ordinal value for each component. The score ranges from 0 to 13 points, with 0 representing the best outcome and 13the worst [30].

2.4. Data Analysis Procedure

The data were analyzed using SPSS (IBM) 25. Parametric and non-parametric tests were decided after the assessment of normality.

2.4.1. Change over Time. The difference between pre-treatment and post-treatment readings was calculated using Friedmann Test. This non-parametric test compared the group at different intervals.

2.4.2. Difference between Groups. Mann-Whitney U Test (non-parametric test) was used to compare two populations at different intervals.

3. RESULTS

The screening of 36 participants was done, of whom 30 were selected for the study and allocated into two groups (group A=15, Group B=15). Three participants dropped out due to some personal reasons (one from

group A and two from group B, resulting in an analysis of data from 27 participants.

The normality of the data was tested through the Shapiro-Wilk test. The data of this study were not normally distributed as all of the pre-treatment P-values were less than 0.05. Hence non-parametric tests were used for the analysis of data. The mean age of patients in group A was 28.43±3.39, and the mean BMI was 27.71±3.93. The mean age of patients in group B was 27.85±3.89, and the mean BMI was 26.69±4.04. Demographic data is shown in Table 1.

Table 1. Baseline Descriptive Measures of Group A and Group B

		N	Minimum	Maximum	Mean ± SD
Group A = Scar Mobilisation and Core Stability	Years of Marriage	14	2	14	6.64 ± 3.52
	Number of Pregnancies	14	1	5	2.21 ± 1.25
	Number of Months Since Surgery	14	2	12	6.07 ± 3.24
Group B = Scar Mobilisation	Years of Marriage	13	2	12	5.54 ± 3.40
	Number of Pregnancies	13	1	5	2.23 ± 1.30
	Number of Months Since Surgery	13	3	18	8.54 ± 4.70

Comparison of NPRS scores between both the groups shows mean rank at post-treatment I in group A was 15.89 and 11.96 in group B. A significant difference was seen in post-treatment II as compared to post-treatment I in both groups. Hence both groups showed a reduction in pain after treatment shown in Table 2. No significant differences were seen in post-treatment I and post-treatment II values in both ODI, MSMT and VSS groups. Hence both groups do not show a significant difference after treatment sessions compared to each other shown in Table 2.

Table 2. Between Group Analysis (Man Whitney Test)

	Groups	*N*	Mean Rank	Median	*Z*-Score	*p*-value
Oswestry Disability Index						
Post Treatment 1	A	14	14.14	31.00	-0.07	0.923

	Groups	*N*	Mean Rank	Median	*Z*-Score	*p*-value
	B	13	13.85			
Post Treatment 2	A	14	12.32	26.00	-1.14	0.253
	B	13	15.81			
Numeric Pain Rating Scale						
Post Treatment 1	A	14	15.89	3.00	-1.34	0.179
	B	13	11.96			
Post Treatment 2	A	14	10.64	1.00	-2.349	0.019
	B	13	17.62			
Manual Scar Mobility Testing						
Post Treatment 1	A	14	15.00	2.00	-0.723	0.470
	B	13	12.92			
Post Treatment 2	A	14	12.75	1.00	-0.929	0.353
	B	13	15.35			
Vancouver Scar Scale						
Post Treatment 1	A	14	12.89	6.00	-0.793	0.428
	B	13	15.19			
Post Treatment 2	A	14	13.00	5.00	-0.702	0.483
	B	13	15.08			

The Freidman Anova test showed a significant difference in ODI, NPRS, MSMT, and VSS pre and post-treatment values. Both groups demonstrated improvement after treatment sessions, as shown in Table 3.

Table 3. Within Group Analysis (Friedmann Anova)

	Group A (*n* =14)		Group B (*n* =13)	
	Median	Mean Rank	Median	Mean Rank
Oswestry Disability Index				
Pre Treatment	50.00	3.00	34.00	2.85
Post Treatment 1	32.21	1.96	30.00	1.88
Post Treatment 2	25.20	1.04	28.89	1.27
p-value		0.00		0.00
Numeric Pain Rating Scale				
Pre Treatment	6.00	3.00	4.00	2.65
Post Treatment 1	3.50	2.00	3.00	1.96
Post Treatment 2	1.00	1.00	3.00	1.38
p-value		0.00		0.00
Manual Scar Mobility Testing				
Pre Treatment	3.00	2.75	3.00	2.81
Post Treatment 1	2.00	2.18	2.00	1.92
Post Treatment 2	0.50	1.07	1.00	1.27
p-value		0.00		0.00

	Group A (n =14)		Group B (n =13)	
	Median	Mean Rank	Median	Mean Rank
Vancouver Scar Scale				
Pre Treatment	6.50	2.89	6.00	2.69
Post Treatment 1	5.00	1.93	6.00	2.04
Post Treatment 2	4.00	1.16	5.00	1.27
p-value		0.00		0.00

4. DISCUSSION

The main purpose of this study was to determine the effects of scar mobility exercises and core stability exercises on scar tissue mobility and lumbopelvic pain after C-section. The results indicated that combining scar mobilization techniques with core stabilization exercise contributed to a more significant reduction in low back pain and scar pain. NPRS scores in group A, which received both scar mobilization and core stabilization exercises, showed more remarkable improvement in their mean rank values than in group B which received only scar mobilization (p<0.05). ODI, MSMT and VSS scores improved equally in both groups.

Previously a study was conducted by Nayyab et al. [25] on postpartum females in which supervised core stability exercises were incorporated into one group and unsupervised home-based core stability exercises into the other group. ODI and NPRS scores were significantly reduced in the supervised core stability exercises group. Ghavipanje et al. [23] conducted a study on dynamic neuromuscular stabilization exercises and general exercises compared in postpartum women. After the intervention, it was concluded that the dynamic neuromuscular stabilization exercises were more effective in improving NPRS. These studies support the current study research findings, as the results are according to this previous literature.

Another study ElDeeb et al. [4] conducted a study in 2019, used pelvic floor muscle training with stabilization exercises and analyzed its effect on pain and disability in postpartum females. The results were calculated through ODI to measure disability, and patients showed reduced scores after treatment sessions in both groups. The findings of all these studies are consistent with the results of our research.

Comesaña et al. [16] underlined that scar therapy can improve scar appearance and mobility, even after the complete remodelling process of the scar. Myofascial Induction Therapy (MIT) on C-section scar (at a deep

and superficial level) can improve functionality and promotes a better quality of life in the individual. Another study [28] concluded that soft tissue mobilization of the C-section scar could decrease the scar's stiffness and the associated pain. Ismail and Elgzar [15] conducted a study on soft tissue mobilizations on scar and support the results of the current study. Soft tissue mobilizations proved to be beneficial in improving the mobility of the scar, pain and disability. These were assessed through NPRS and ODI scores. All these studies support the current research because both groups saw improved scar mobility after scar mobilization.

All the literature reviewed indicates the positive effect of core stability exercises on the LBP. These exercises reduce the pain and disability in females who have back pain after delivery and help them to lead a better life and improve their overall functioning. However, it is also evident through the literature that scar mobilization techniques are beneficial to enhance scar mobility and reduce the associated problems like lumbopelvic pain, stiffness and disability. According to the researcher, there is a lack of study that uses both scar mobilization techniques and core stabilization exercises for females suffering from LBP postpartum. Both interventions provide the basic comprehensive treatment protocol for females suffering from LBP after C-section. Previous literature proves the importance of exercises in the postpartum period to minimize the problems, and starting the early exercise intervention plan can significantly improve patient's daily living activities.

There are several limitations of the study. Firstly, there was no follow-up considered due to time constraints and long-term effects were not determined. Additionally, both groups were treated by the same physiotherapist with small sample size and with short term follow-up. Stress to mother related to baby's health or any other factor couldn't be controlled in the current study. For future research, it is recommended to conduct studies with a longer follow-up period and a larger sample size to better assess the effectiveness and retention of the intervention.

4.1. Conclusion

This study concluded that scar mobilization techniques with core stability exercises were more effective than scar mobilization techniques in treating females with lumbopelvic and scar site pain after caesarean section.

CONFLICT OF INTEREST

The author of the manuscript has no financial or non-financial conflict of interest in the subject matter or materials discussed in this manuscript.

DATA AVAILABILITY STATEMENT

The data associated with this study will be provided by the corresponding author upon request.

FUNDING DETAILS

No funding has been received for this research.

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