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ORIGINAL ARTICLE

Comparative Effects of Kinesiotaping and Electrical Muscle Stimulation on Low Back Pain and Disability Associated with Diastasis Recti

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ABSTRACT

OBJECTIVE: To compare the effects of Kinesio taping and electrical muscle stimulation on low back pain anddisability associated with diastasis recti.

METHODOLOGY: A Randomized clinical trial was conducted on a sample size of 48 postpartum females of diastasis recti. All participants were randomly allocated to either the EMS group or the KT group for a total of 4 weeks. A protocol was followed, consisting of 3 sessions per week, each lasting 40 minutes, for both groups. The outcome was measured using the two-finger method to assess inter recti distance and manual muscle testing (MMT) for abdominal muscle strengthening, as well as the Numeric Pain Rating Scale (NPRS) for low back pain and the Ronald-Morris Disability Questionnaire (RMQ) for level of disability.

RESULTS: The statistically significant p-value of MMT for the pre-treatment session of both groups was .013, post- treatment session value was .002, and in both groups, a p-value of NPRS for the pre-treatment session was 0.081 and the post-treatment value of .001 while p-value of RMQ.105 for pre-treatment for both group and .0000 for post-treatment which shows that significant decrease in pain and disability level in both groups after taking intervention. In both groups, the total IRD to measure inter-rectal distance was 4.00 at the pre-level and 3.00 at the post-level.

CONCLUSION: The group receiving EMS shows more significant results in terms of improving low back pain, disability, and RA strength compared to the group receiving KT treatment.

KEYWORDS: abdominal muscle, Diastasis recti, Electrical muscle stimulation, females, Kinesio taping, Low back pain, postpartum

INTRODUCTION

A protruding abdomen and possible low back pain are symptoms of diastasis recti abdominis (DRA)[1], a condition in which the rectus abdominis muscles separate along the midline. Between 30% and 60% of women experience it after giving birth, making it a common condition among postpartum women[2]. A common symptom of DRA is low back pain (LBP)[3], which is brought on by weakening of the abdominal muscles and changes in spinal mechanics[4]. This illness can cause severe disability that impairs everyday functioning and quality of life. To reduce pain and regain function, effective management is essential.

Several interventions have been investigated to treat DRA and related low back pain (LBP)[6]. Kinesio taping (KT) is a therapeutic method that supports muscles and joints without limiting movement by applying elastic tape to the skin[7]. Research has shown that it can effectively alleviate pain and improve function in a range of musculoskeletal disorders[8].

To strengthen muscles and enhance function, electrical muscle stimulation (EMS) utilizes electrical impulses to induce muscle contractions[9]. According to research, EMS can help treat DRA by strengthening the muscles in the abdomen and reducing low back pain[10]. Although KT and EMS have individual advantages, few studies have compared their effects on LBP and DRA-related disability[11]. By contrasting the effectiveness of KT and EMS in managing LBP and disability in postpartum women with DRA, this study seeks to close this gap.

The purpose of this study is to investigate the potential benefits of NMES and kinesio-taping for abdominal muscle strengthening, aiming to decrease inter-recti distance and reduce low back pain associated with diastasis recti, as well as decrease their related disabilities. It may be beneficial to clinicians working in various physiotherapy settings.

METHODOLOGY

Study Design: Randomized clinical trial (Clinical trial No: NCT05834153)
Sample Size: The sample size was calculated using the OpenEpi calculator, based on the outcome measure MMT from a previous study[2].
Sampling Technique: Random allocation was used to select the sample, and then it was randomly allocated into groups using the Lottery Method.
Study Setting: Islam Teaching Hospital, Mughal Surgical Clinic, Gujranwala. The study was completed 8 months after the approval of the synopsis**.** The Sampling technique was used to select the sampleand then randomly allocated into groups through Lottery Method
Random allocation: Random allocation through the lottery method by placing name chits in a bowl, randomly picking one by one and allocating 24 individualsin each group.
Inclusion Criteria: Age 20 to 40 years, Diastasis recti more than 2 or 2.5cm, Diastasis recti at the level of umbilicus by two finger method[7], 6 weeks postpartum cesarean sectionfemales, Multigravida females, Low back pain due to DR by NPRS above 4 [6]**.**
Exclusion Criteria: Normal vaginal delivery, Episiotomy, Primi gravida women, History of abdominal hernia, History of any abdominal surgery[8].
Data Collection Tools: Numeric Pain Rating Scale: A pain screening tool known as the Numeric Pain Rating Scale (an outcome measure) is frequently used to evaluate the intensity of pain on a scale from 0 to 10, with 0 indicating no pain and 10 indicating the greatest possible pain. Manual muscle testing (MMT) for strength: Using a manual muscle test recommended by Dr. Lovett, the strength of the rectus abdominis muscle will be measured on a 0- to 5-point scale. The patient was lying face downwith their arms at their sides in a crook posture. The participant was instructed to raiseand reach up until the lower end of the scapula was visible. If successful, they were asked to move to the next position, which involved crossing their hands over their chest, bending forward, and elevating the scapula off the Table. After the patient successfully acquired this position, a forward-reaching motion with crossed hands was used to support the back of the head. The scores wererecorded based on the postures that the patientcould successfully attain and maintain, i.e., 3,4, and 5 for each of the positions stated above[10]. The Roland Morris Disability Questionnaire (RMDQ) was used to assess the degree and severity of low back pain-related impairment, as indicated by higher scores on a 24-point scale. The questionnaire was administered at the start of treatment and again at the end, and clinical improvement was determined using the results[11]. **Two-finger method:** Inter Recti Distance (IRD) - The finger method was used to measure the inter recti distance. The patient was instructed to elevate their head, shoulders, and arms until the lower angle of their scapula exited the Table during expiration while lying in the hook-lie position. To measure the inter recti distance in this posture, the tester laid her fingers horizontally at the umbilicus' level. Diastasis recti abdominis is present when there is a gap of two fingers' breadth or greater[12]. Data analysis was performed using SPSS for Windows software, version 25.
Data Collection Procedure: All participants were informed of the study's objective and procedure beforeit began. Each of them consented to the projectand the use of their data for research purposes by signing a written agreement. This was to verify that the research was conductedin compliance with all applicable rules and regulations. Women who fulfilled the inclusion criteria were enrolled in this study. **Recruitment**: A total of 48 participants were included in this study, all of whom continue to be followed up. **Randomization:** Subjects were randomly assigned to two groups using a lottery method. **Blindness**: Not any.

Intervention: EMS Group A (EMS + Exercises) - This consisted of 24 patients who received neuromuscular electrical stimulation (NMES) and core stabilization exercises.
The participants were instructed in the application process by relaxing their abdominal muscles. The rectus abdominis muscles' pubic crest and xiphoid process were bilaterally covered with four big rectangular electrodes, which were used to stimulate the muscles. The electrodes were fastened in place with straps. The parameter values used in this investigation were a pulse frequency of 80 Hz and a pulse width of 0.1 to 0.5 ms. The stimulation was applied for a total of 30 minutes, and when a strong enough observable muscular contraction was produced, the intensity was gradually increased NMES withcore stabilization exercises (3 sessions per week for 4 weeks)[13]. KT Group B (KT + Exercises) consists of 24 patients who received Kinesio taping and core stabilization exercises. For four weeks, this group received twice-weekly KT applications to the rectus abdominis muscle (RAM), the oblique abdominal muscles (OAM), and the caesarean incision. When the patient was prone, the scar method was first applied using an I band with 50% tension onthe caesarean incision. Then, RAM was taped using the muscle method, from the muscle's origin to its insertion, with a tension of between 15 and 25%. After asking the patient to expand their abdomen by taking deep abdominal breaths, the band was started at the symphysis pubis with no strain and finished at the xiphoid process[14]. Finally, it was carried out on the muscles of the right and left external oblique. Starting with no strain from the bottom end of the 6th to 12th ribs, the process was performed. Next, the hip was rotated and flexed in the opposite direction, and a band was taped to the pubic bone with a tension of between 15% and 25%. This was followed by Kinesio taping and core stabilization exercises, three sessions per week for four weeks.
Core stabilization exercises: This exercise program provided guided, explicit demonstrations of the exercises to both Groups A and B's subjects. Throughout the 4-week intervention program, each exercise was performed 20 times, with the number of repetitions increasing by four each week. The following exercises were performed: crunches, reverse crunches, reverse trunk rotation, head lifts with pelvic tilt, the drawing-in manoeuvre/isometrics (with a 5-second hold), and the U-seat exercise. Each therapy session lasted forty minutes[16].

RESULTS

A total of 48 participants were part of this study. Twenty-four participants in each group were allocated to Group A and Group B via lottery method. A sample size of 48 was calculated, assuming a 10% attrition rate. All 48 participants completed the study, out of a total sample size of 48, and there were no dropouts. After collecting the data, analysis was performed using the latest version of SPSS. Group A received electrical muscle stimulation and core stabilization exercises, while Group B received kinesiotaping and core stabilization exercises; for the presentation of demographics and categorical features, frequency, mean ± SD, and percentage were used.

Table I: Test of normality using the SHAPIRO-WILK test

Variables	Shapiro-Wilk		
	Statistic	df	Sig.
Pre RA MMT	.689	48	.000
Pre RMQ	.942	48	.019
Pre NPRS	.873	48	.000
Pre IRD	.783	48	.000

In **Table I**, the level of significance was accepted as $p < 0.05$. The normality of the data was tested using the Shapiro-Wilk test, which yielded a p-value less than 0.05, indicating that the data were normally distributed. Therefore, non-parametric tests were applied for analysis.

Table II: Demographics

Group	Mean Age (± SD)	Mean Height (± SD)	Mean Weight (± SD)	Mean BMI (± SD)
Group A (EMS + Core Stabilization Exercises)	30.88±4.26 years	63.58±1.47 inches	67.29±4.21 kg	25.91±2.01
Group B (Kinesio Taping + Core Stabilization Exercises)	32.00±4.58 years	64.79±1.59 inches	69.63±5.53 kg	25.71±2.12

In **Table II**, the baseline statistics for both groups are presented as Mean ± SD. It consists of a total of 48 female participants. The mean Age of participants in Group A was 30.8750, and the standard deviation was 4. 25607. The Height of the patients was measured in inches, with a mean of 63.5833 and a standard deviation of 1.47196. The standard deviation of Weight in the same group is 4.20640, with a mean of 67.2917. Meanwhile, the mean value of BMI in this group was 25.9125, and the standard deviation was 2.00658. At the same time, Group B has an average age, Height, Weight, and BMI of 32.0000, 64.7917, 69.6250, and 25.7083, respectively, with standard deviations of 4.57783, 1.58743, 5.53104, and 2.12417.

Table III: Between-group comparison of Group A and Group B for RMQ and MMT using (Mann Whitney test)

Treatment	Groups	Median	Mean Rank	p-value
Pre RMQ	A(EMS)	20.0000	27.71	.105
	B(KT)	20.0000	21.29	
Post RMQ	A(EMS)	10.0000	27.71	.0000
	B(KT)	10.0000	21.29	
Pre Rectus abdominis MMT	A(EMS)	3.0000	28.42	.013
	B(KT)	3.0000	20.58	
Post Rectus abdominis MMT	A(EMS)	4.0000	29.92	.002
	B(KT)	4.0000	19.08	

According to **Table III**, the between-group comparison of rectus abdominis MMT shows that the pretest p-value for both groups was 0.013, and the post-test value was 0.002. The pre-treatment p-value of RMQ in both groups is 0.105, and the post-treatment p-value is 0.0000, indicating that the results are significant.

Table IV: Between-group comparison of Group A and Group B for NPRS and IRD using (Mann Whitney test)

Treatment	Groups	Median	Mean Rank	p-value
Pre NPRS	A(EMS)	6.0000	21.19	.081
	B(KT)	6.0000	27.81	
Post NPRS	A(EMS)	3.0000	18.60	.001
	B(KT)	3.0000	30.40	
Pre IRD	A(EMS)	4.0000	22.85	.356
	B(KT)	4.0000	26.15	
Post IRD	A(EMS)	3.0000	22.85	.356
	B(KT)	3.0000	26.15	

In **Table IV**, the pre-treatment p-value of NPRS for both groups is 0.081, and the post-treatment value is 0.001, indicating that the results are significant and there was a reduction in pain after treatment. **Table IV** presents the between-group comparison for inter-recti distance, with a p-value of 0.356 for both the pre- and post-treatment groups.

Table V: Within-group comparison of Group A (EMS) and Group B (KT) for change in strength, level of disability, pain and inter recti distance (Wilcoxon test)

Tool	Group A(EMS)				P-Value	Group B(KT)				P-Value
	Pre-treatment		Post-treatment			Pre-treatment		Post-treatment		
	Median	Mean Rank	Median	Mean Rank		Median	Mean Rank	Median	Mean Rank	
RA MMT	3.0000	12.50	5.0000	.00	.000	3.0000	12.50	4.0000	.00	.000
RMQ	20.0000	12.50	8.0000	.00	.000	20.0000	12.50	12.0000	.00	.000
NPRS	5.0000	12.50	3.0000	.00	.000	6.0000	12.50	3.0000	.00	.000
IRD	4.0000	12.50	3.0000	.00	.000	4.0000	12.50	3.0000	.00	.000

Table V, within-group comparison for pre-treatment and post-treatment for both groups using the Wilcoxon test, describes that for Group A, the p-values for MMT, RMQ, NPRS, and IRD were all 0.000 for both pre- and post-treatment. While in Group B, the p-value for MMT, RMQ, NPRS, and IRD was 0.0000.

DISCUSSION

In a previous study, **Gandhali Situt et al.** (2021) investigated the efficacy of NMES and kinesio taping combined with core stability exercises on inter recti distance, abdominal muscular strength, and low back discomfort in postpartum women with diastasis recti. This study demonstrated a significant improvement in the inter recti distance in both groups, as well as a notable change in muscle strength and low back pain in both groups. However, the application of NMES, along with core stabilization exercises, was found to be more effective on all outcome measures[17]. The current study showed that both treatment techniques are equally effective, with significant improvements in low back pain, disability, rectus abdominis strength, and a decrease in IRD. However, the treatment group receiving EMS treatment shows more significant results[18].

In a previous study, **Pournima A. et al. (**2020) compared two groups: one receiving kinesiotaping along with abdominal exercises and the other receiving abdominal exercises alone. This study showed a greater effect of kinesiotaping, along with abdominal exercises, in all aspects of strength, pain, and IRD[19]. In the Present Study, EMS was shown to have a significant effect in reducing IRD, pain, and disability and improving strength, compared to other treatment techniques.

In a Previous Study, **Hanan K. Mohamed et al.** (2020) conducted research by comparing the effects of kinesiotaping on abdominal muscle strength in postpartum females with diastasis recti who underwent cesarean sections. He claimed that kinesiotaping, along with abdominal exercises, was more effective than abdominal exercises alone in improving strength and reducing inter recti distance. In the present study, the results showed that EMS combined with exercises yielded more significant results than KT alone.

In a previous study, **Ilia M. Kamel et al.** (2017) investigated the efficacy of Neuromuscular Electrical stimulation and abdominal exercises in the recovery from postnatal diastasis recti. The study showed that EMS when combined with exercises, yields better results compared to abdominal exercises alone[20]. In the present study, the effect of EMS and KT, along with exercises, on postpartum diastasis recti was significant. However, EMS, along with exercises, was more beneficial in all aspects for treating Dr. as compared to KT with exercises.

CONCLUSION

The current study concluded that both treatment techniques are effective, showing significant improvement in low back pain, disability, rectus abdominis strength, and decreasing IRD. However, the treatment group receiving EMS treatment shows more critical results in terms of improving low back pain, disability and RA strength as compared to other treatment groups receiving KT treatment.

Ethical permission: Riphah College of Rehabilitation and Allied Health Sciences, Lahore, Pakistan, IRB letter No. REC/RCR & AHS/23/0523.
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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Komal A: Substantial contributions to the study design, acquisition of data
Gul H: Substantial contributions to the study design, acquisition of data, and manuscript writing
Tariq M: Substantial contributions to the study design, acquisition of data
Butt MS: Manuscript writing

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