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Effectiveness of 6 week Pilates training on diastasis recti in post partum women-A pilot study

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Abstract
Background: Pregnancy is considered as the most important phase in a women's life in which various anatomical and physiological changes occur. The abdominal muscles, particularly both sides of the rectus are stretched to the point of their elastic limit by the end of pregnancy. Diastasis recti is a condition in which the rectus abdominis muscle separates in midline at the linea Alba. Any separation larger than 2cm is considered significant. The transverse abdominis, pelvic floor, deep multifidus and diaphragm form a muscular corset and the strengthening of core control muscles of the lower abdominal region during the post-natal period is crucial as it helps support the spine, back, decreases abdominal separation, blends toning and alleviates muscle tension deriving from repetitive physical movement. Pilates is a form of exercise with goals of improving flexibility, core strength, Posture and coordinate movement with breath.
Objective: To study the effectiveness of 6-week pilates training on diastasis recti in postpartum women.
Method: For this pilot study, pre and post intervention data was collected. A number of (N=12) female participants with diastasis recti 6-week postpartum were selected. Diastasis recti was measured every time with the digital vernier caliper.
Results: A total 12 participants were selected for this study between the age group of 25 to 35 years. The members were arbitrarily partitioned into two groups (experimental and control). The mean value of diastasis recti pre intervention for the control group was 2.7±0.261 cm and post intervention the mean value of diastasis recti was 2.48±0.299 cm. The mean value of diastasis recti pre intervention for the experimental group was 2.61±0.279 cm and post intervention the mean value of diastasis recti was 2.016±0.331 cm. The p value for the comparison of post intervention diastasis recti of both groups is 0.0284 which is considered to be statistically significant.
Conclusion: The result of this study shows that pilates exercises are very effective in reducing diastasis recti in postpartum women.

Keywords: pregnancy, diastasis recti, postpartum women, pilates training

Introduction

"Pregnancy" is considered as the most important phase in a women's life. Pregnancy is normal physiological process which is usually experienced by healthy women in her life. Mainly the pregnant or postnatal patient presents with unique gender based clinical challenge for physical therapist. [1] There are various anatomical and physiological changes that occur during pregnancy. Uterus increases from prepregnant size of 5 by 10 cm to 25 by 36 cm; it increases 5 to 6 times in size. By the end of pregnancy, each muscle cell in the uterus increases approximately 10 times over its pre-pregnancy length. The abdominal muscles, particularly both sides of rectus are stretched to the point of their elastic limit by the end of pregnancy, leading to greater decrease the muscles ability to generate strong abdominal contraction [1] Diastasis recti is condition in which the rectus abdominis muscle separates in midline at linea alba. The diastasis is a gap between the recti abdominal muscle greater than 25 mm [2]. Any separation larger than 2cm or 2 finger width is considered significant. It can occur above, below or at level of umbilicus [1, 2, 3, 4] The causative factors for diastasis recti during pregnancy are increased level of relaxin, progesterone and estrogen hormones that causes soften of connective tissues and weakening of the linea alba. [5, 6] The tendinous raphe of rectus abdominis course from xiphoid process to symphysis pubis and undergo the influence of these hormonal changes. Coupled with hormonal softening of linea alba thus the continuously increasing stretch placed on the abdominal wall by growing fetus. As a result, amount of tension on an already weakened structure produces predisposition to separation and results in diastasis recti [3, 4, 7, 8] Diastasis recti presents with the following symptoms, no pain at rest is reported by majority of the women, on the other hand, discomfort, pain, bulging and corset instability are reported during physical activities. A tiny percent of pain is perceived when the separation of recti muscles is large, the pain may be located in the lower bank or within the abdominals. There is higher rate of occurrence in multiparous women as there has been repetitive stretching of the muscles. The top of the pregnant uterus can be seen bulging out of the abdominal wall in the later part of pregnancy. The risk factors of diastasis recti are age, women over the age of 35, high birth weight of child, multiple birth pregnancy, caesarean section, and excessive abdominal exercises after the first trimester of pregnancy, massive weight loss occurring spontaneously or after bariatric surgery, previous or repeated abdominal surgery. [9, 10] So in this study, focus is given on strengthening and facilitation training of abdominal muscles to determine effects on reduction of diastasis recti in postnatal women.

It is believed that women with diastasis recti have a greater number of pregnancies and deliveries [11] however the results of

the present study showed that diastasis recti above the umbilicus has similar prevalence in primiparae and multiparae. It can be linked to muscle weakness resulting from the recent pregnancy in both groups. The prevalence and mean of diastasis recti below the umbilicus was higher in multiparae. It can be reasoned by parity and numerous pregnancies, which are a contributing factor for the total mechanical stress on the connective tissue of the abdominal wall. As the pregnancy progresses, the uterus weight and size increases, influencing the musculoskeletal morphology of the trunk, increasing the distance between the muscle insertions and producing muscle stretching [12]. The transversus abdominis, pelvic floor, deep multifidus and diaphragm or the deep core stabilizing muscles form a muscular cylinder, which supports the spine and the pelvis; these muscles work together as a unit to ensure and maintain trunk stability [13, 14] strengthening the core control muscles of the lower abdominal region during the post-natal period is crucial as it helps create a muscular "corset". This supports the spine and the back, decreases abdominal separation, blends toning and alleviates muscle tension deriving from repetitive physical movement [15] Pilates' initial concept mixed elements of gymnastics, martial arts, yoga and dance, focusing on the relationship between the body and mental discipline. [16] The goal of Pilates training is to improve general body flexibility and health, core strength and posture, and to coordinate movement with the breath [16]. Pilates has been known to improve the strength and flexibility of muscles, particularly the abdominal muscles, lower back, hip and buttocks i.e. the core musculature thus helping in improving core stability.

Pilates can be an aerobic and non-aerobic form of exercise. It requires concentration and focus. Pilates lengthens and stretches all the major muscle groups in your body in a balanced fashion. The main requirement is to find a centre point in order to control your body during movement. Every exercise has a pre-set rhythm, placement and breathing pattern. In Pilates, there is no straining or sweating as the muscles are not worked till exhaustion but with intense concentration. [17]

The two basic forms of Pilates are:

- Equipment-based Pilates – It includes equipment which works against spring loaded resistance, such as the reformer which consists of a moveable carriage that has to be pulled and pushes along its tracks. Some forms of Pilates include weights (such as dumbbells) and other types of small equipment that offer resistance to the muscles.
- Mat -based Pilates – this is a series of exercises performed on the floor using gravity and your own body weight to provide resistance. To improve posture, balance and coordination, conditioning the deep, supporting muscles of the body is the main goal.

Principles of Pilates [17]

- **Concentration:** One should focus on their whole body to guarantee smooth movements while performing Pilates. The main motive being how the exercises are performed rather than the exercise itself.
- **Control:** Every exercise in Pilates must be done with control. The base being that the performer has to be in control of the body rather than it being along with the momentum.
- **Centering:** In order to control the body efficiently, there has to be a starting place, known as the center or the powerhouse. The powerhouse includes the abs, upper and lower back, butt, hips and inner thighs. All movement in Pilates should begin from your center, your powerhouse and flow out to the limbs.
- **Flow:** When the exercises flow into each other, they help build strength and stamina, like the exercises in Pilates. Appropriate transitions and economy of movement is inexpensive and it separates beginners and advanced practitioners.
- **Precision:** Instead of performing exercises with poor technique and increasing repetitions, Pilates focuses on precise and perfect movement. A lot can be said about a person by observing that person while walking, this is possible for an expert pilates instructor as the precision is eventually carried over in everyday life.
- **Breathing:** In Pilates, the thumb rule is to breathe out on effort and breathe in on the return. Coordinating the movement and your breathing is very important in Pilates. Like everything in Pilates you should concentrate on each breathe and feel the engagement of your powerhouse.

Materials and Method

Subjects

The study was conducted on twelve postpartum women having diastasis recti separation between2-3cm, at the level of umbilicus. The subjects had an BMI under or equal to 29kg/cm^2. All the subjects were in the age group of 25 to 35 years and 6 weeks postpartum [18, 20].

Any females with history or complains of urinary incontinence, abdominal hernia was excluded from the study. Also, any subjects who had undergone any abdominal surgery (except caesarean section) were excluded from the study. The other subjects who were not included were those with any deformities or neurological conditions.

The subjects were instructed to not be a part of any other exercise program during the study duration. The subjects were randomly divided into two groups (experimental and control).

Experimental group underwent pilates training for 6 weeks and the control group underwent conventional training for 6 weeks.

Instrumentations

1. *Height- Weight scale:* Universal scale was used to measure the height and weight of all subjects to calculate their BMI before commencing the treatment.

$$BMI = (weight/height^2)$$

2. *Digital vernier caliper:* Oleander Electronic Carbon fiber composites Digital Vernier Caliper with extra strong carbon fiber composites and LED screen was used to assess the separation between the two recti before and after the intervention of 6 weeks in both groups.

It has a measuring range of 0-150mm or 0-6″ and a resolution of 0.1mm or 0.01″. It can be used to measure inside and outside diameter, with two sets of jaws and a probe. The caliper was placed between the two sets of points and distance was measured between the recti muscles.

Procedures

A. *Evaluation procedure*

Measurement of diastasis recti

The distance between the recti muscles at the level of umbilicus was measured at the beginning and again at the end of the study duration i.e. 6 weeks. Each subject was tested in the same position. The subject was in crook lying and slowly raised her head and shoulders, the therapist palpated the medial edges of the recti muscles, placed the digital vernier caliper and recorded the reading. To ensure standardization, three trials were taken for each assessment and the mean was recorded.

B. *Treatment procedure*

I - Conventional exercise program [23]

All the subjects in the control group (n=6) underwent a conventional exercise program which consisted of static abdominal exercise, head raise, head raise with pelvic tilt, straight leg raise with posterior pelvic tilt, bridging and superman in quadruped. The women were asked to hold each final position for 10 secs and then relax. This program was conducted 2 times per week, 1 hour per session, entirely for 6 weeks. There was an increase in the number of repetitions after every two weeks.

II – Pilates training program [19, 21, 22]

All the subjects in the experimental group (n=6) underwent a pilates training program which consisted of spine stretch, saw, mermaid, one leg stretch, double leg stretch, crisscross, spine twist, one leg kick, double leg kick, shoulder bridge, one leg circle and side kick. For every stretching exercise, 10 sec hold was followed by 10 sec relaxation. For every strengthening exercise, 5 sec contraction was followed by 2 sec relaxation. This program was conducted 2 times per week, 1 hour per session, entirely for 6 weeks. There was an increase in the number of repetitions after every two weeks.

Conclusion

Statistical analysis

The data was compared and analysed using the paired t-test for intra group data and using the unpaired t-test for inter group data. The mean values and standard deviation were noted.

Results

Table 1

	Mean	Standard Deviation	t - value	p - value	Significance
Pre	2.7	0.261	7.0502	0.0009	Extremely significant
Post	2.48	0.299			

Shows the data for the control group which was prescribed the conventional exercise program, there were (n=6) subjects in this particular group.

Table 2

	Mean	Standard Deviation	t - value	p - value	Significance
Pre	2.61	0.279	13.416	0.0001	Extremely significant
Post	2.016	0.331			

Shows the data for the experimental group which was prescribed the pilates training program, there were (n=6) subjects in this particular group.

Table 3

	Mean	Standard Deviation	t-value	p-value	Significance
Experi-Mental	2.016	0.331	2.56	0.0284	Significant
Control	2.48	0.299			

Compares the data of both the groups which was collected after their respective intervention was completed. The data here is of (n-12) subjects.

Conclusion

The study concluded that postpartum women after a duration of 6 weeks, benefitted from Pilates training program more than the conventional exercise program. There was a larger difference in the pre and post intervention inter recti separation distance in the experimental group as compared to the conventional exercise program. So, it can be advised that Pilates training program is effective in reduction of diastasis recti separation in 6 weeks postpartum women.

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