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EFFECTIVENESS OF CORE STRENGTHENING ON LOW BACK PAIN IN DIASTASIS RECTUS ABDOMINUS

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ABSTRACT
OBJECTIVES : To assess and decrease inter recti distance and intensity of pain in women with diastasis rectus abdominus.
METHODS AND MATERIALS: Pretest and posttest experimental study design of 15 subjects with mean age from 35 to 55 years have a diastasis rectus abdominus and low back pain. This is used to find an inter recti distance by using digital caliper, they are participated in core strengthening program for 3 weeks. by focusing on core muscles activation with coordinated breathing. Inter recti distance and low back pain were assessed using digital caliper and visual analogue scale.
RESULTS: The 3 week of core strengthening program significantly decreased in inter recti distance above and below umbilicus at rest. Decrease of inter recti distance and intensity of low back pain.
CONCLUSION:After 3 weeks of intervention of core strengthening showed significant improvement on reducing pain intensity and inter recti distance. However, core strengthening was found to be more effective.

KEYWORDS: Diastasis rectus abdominus, inter recti distance, low back pain, core strengthening, visual analogue scale.

INTRODUCTION

Global burden of diseases studies has defined low back pain as pain in the area on the posterior aspect of the body from the lower margins of the twelfth ribs to the lower gluteal folds with or without pain referred into one or both lower limbs that lasts for at least one day [(14)]. These structures get affected due to various causes like lifestyle modification, aging, pregnancy and postural disturbance. Low back ache is described as pain varying from person to person like acute and chronic, whereas acute low back ache resulted from injuries of muscles, ligaments, joints or discs, some of the causes like herniated disc, degenerative disc diseases are all due to aging [(11)]. In pregnancy the low back pain is developed for women who underwent lower segment cesarean section (LSCS). This is due to anatomical changes taking place in the body. During pregnancy the fetus growth enlarges the uterus, where this growth changes in the abdominal wall gets enlarged and stretched till the birth of fetus. This makes the muscle loosen the tone in the abdominal site. Muscles provide stability for low back and abdominal muscles also act in stabilization of low back [(4)]

Diastasis recti is increase in the width of Linea Alba. It is attached from xiphoid process, sternum and to the pubic symphysis [(5)]. The fused layers are separated in time of pregnancy, mainly in Cesarean section the structures get more weakened. Linea Alba has a normal width for examining whether the separation between the paired recti muscles occurred are normal. When the width increases of Linea Alba leads to diastasis recti abdominus [(16)]. The distance measuring between bilateral recti muscle is called as inter recti distance i.e., is width of Linea Alba. This causes the integrity of the mechanical control and functional strength of the abdominal wall to reduce because of the abdominal separation or diastasis recti. It leads to altered trunk mechanics, impaired pelvic stability and changed posture, the lumbar spine and the pelvis more weakened [(22)].

The core is a group of muscles that help in stabilizing and controlling the spine. The core also includes the pelvic floor muscles and maintains the strength of core and prevents diastasis recti [(9)]. It is a group of trunk muscles and hip muscles surrounds the spine, muscles such as rectus abdominus, external oblique, erector spinae, quadratus lumborum and hip muscle groups. The intervention of core strengthening for the diastasis recti is a concentration of whole group muscles that support the abdomen and back. Mainly this helps in concentration of musculoskeletal health in the low back patients [(2)]. Regular exercises for core strengthening are done for the further complications occurred due to diastasis rectus abdominus. The intention of core strengthening is to reduce the inter recti distance and low back ache which is caused due to diastasis recti. This is made to decrease in diastasis recti abdominus by causing contraction of the abdominal muscles, produce a horizontal force that pulls the muscles together [(10)].

MATERIALS AND METHODOLOGY

A. DESIGN, SETTING AND PARTICIPANTS

A prospective randomized controlled trial was conducted from December 2020 to May 2021. The participants were selected from the community and treatment is conducted in the clinical setup of NOEL physiotherapy and rehabilitation center in Chennai. The participants included on the criteria of multiparous women age above 35 years to 55 years, who have undergone LSCS with diastasis rectus abdominus and low back pain. The subjects with cognitive disabilities, males, unmarried and nulliparous females and previous abdominal surgeries are excluded. According to the inclusion and exclusion criteria, 15 multiparous women were assigned into training group through a simple randomization schedule: core strengthening. On the first day of treatment, subjects were assessed and pre-experimental test values and after the treatment post-experimental test values are taken. First, the participants were asked to give their demographic and clinical data, then a physical evaluation was performed, which consisted of assessing diastasis rectus abdominus and low back pain. Tools used for diastasis rectus abdominus: vernier caliper used for measuring inter-recti distance. Ranney (25) scale used to classify DRA based on the inter-recti distance [27]. Tool used for low back pain: Visual analogue scale is used to rate the intensity of pain [24].

B. INTERVENTION – CORE STRENGTHENING

Once termed "spinal stabilization", core strengthening applies to the trunk, transverses abdominus, quadratus lumborum, and para spinals including the multifidi; secondary muscles include internal and external oblique and pelvic rotator muscles. Strengthening increases intra-abdominal pressure acting as a natural corset protecting the spine. The goal is to prevent or reduce spine generated pain [20]. As core muscles play a big role in supporting and stabilizing spine and pelvis. This is why it is important to strengthen the core; when core muscles begin to weaken, it can lead to multiple types of injuries, back pain, and pelvis misalignment issues [13]. The core strengthening techniques described below by week wise, as well before starting a daily workout a warmup is given for patients.

FIRST WEEK - Initially starting exercises a whole-body stretching exercise given as warm up to avoid muscle pulls strains. This warmup stretch is completed within 3 to 5 minutes. FREQUENCY: Day 1- starting with 5 repetitions, Day 3to 6 – week 1 exercise 10 repetitions

DURATION: Each day 1 hours Each exercise is 2 to 5 minutes including hold and rest time, so to cover 2 hours patient is advised to do morning 30 minutes and evening 30 minutes.

EXERCISES:1. abdominal compression (lying) 2. pelvic tilt 3. Flutter kick 4. toe taps 5. heel taps 6. full plank [38,39,40,41,42].

SECOND WEEK In this week intervention have been levelled up but follow up of previous week exercise also carried on with increase in frequency and duration. FREQUENCY: Day 1- starting with 5 reptations of newly added with previous week exercises 5 reptations. Day 2 to 6 – week 1 exercises 5 reptations and newly added exercises 10 repetitions. DURATION: Each day 1 hour 30 minutes Each exercise 2 to 5 minutes including hold and rest time, so to cover hours patient is advised to do morning 45 minutes and evening 45 minutes.

EXERCISES: before week follow up with, 1. Ab compression (quadruped position) 2. Standing inclined plank 3. Marching 4. Pelvic bridges 5. Bird dog 6. Single leg reach [43,44,].

THIRD WEEK - From this week abdominal compression of previous weeks position together done with same frequency and duration. Some exercises will be added.

FREQUENCY: Day 1- starting with 5 reptations with previous week exercises 5 reptations Day 2 to 6 – week 1 and 2 exercises 5 reptations and newly added exercises 10 reptations

DURATION: Each day 2 hours

Each exercise 2 to 5 minutes including hold and rest time, so to cover 2 hours patient is advised to do morning 1 hour and evening 1 hour.

EXERCISE: previous 2 weeks follow up with, 1. Side plank 2. Hip twist 3. Spinal twist 4. Flutter kicks 5.c-curving [44].

C. STATISTIC ANALYSIS

The data were analyzed using paired t test. Changes between pre-test and post-test of experimental group. The difference between pre-test and post-test of experimental group is identified by independent t test, where x_1 is the mean value of pretest, x_2 is the mean value of posttest and n is the size of experimental group.

D. DATA PRESENTATION

table 1: variables measured in experimental group

S. NO	DIASTASIS RECTUS ABDOMINUS				PAIN	
	ABOVE UMBLICUS		BELOW UMBLICUS		LOW BACK	
	PRE (cm)	POST (cm)	PRE (cm)	POST (cm)	PRE	POST
1	4	3.5	4.5	4	7	5
2	4.3	4	4.5	4	5	4

3	3	2.5	3.3	3	4	3
4	3.5	3	3.8	3.4	5	4
5	3	2.7	3.5	3	4	2
6	4.5	4	4.7	4	6	5
7	4	3.6	4.5	4	6	5
8	3.3	2.8	3.5	3	3	2
9	4.1	3.5	4.4	4	5	4
10	2.8	2.5	3	2.6	4	3
11	4	3.5	4.5	4	6	4
12	3.5	3	4	3.5	5	3
13	4.5	4	4.8	4.2	7	5
14	3.9	3.5	4.2	3.8	6	5
15	4	3.5	4.5	4	7	6

table 2:comparison of pre-test and post-test values of experimental group

S.NO	VARIABLES	DAYS	MEAN PRE & POST		T- VALUE	P- VALUE
1	Above umbilicus	Day 1 & 21	3.76	3.3	19.56	P <0.05
2	Below umbilicus	Day 1 & 21	4.11	3.63	4.9	P <0.05
3	LBA Pain	Day 1 & 21	8.93	4	10.9	P <0.05

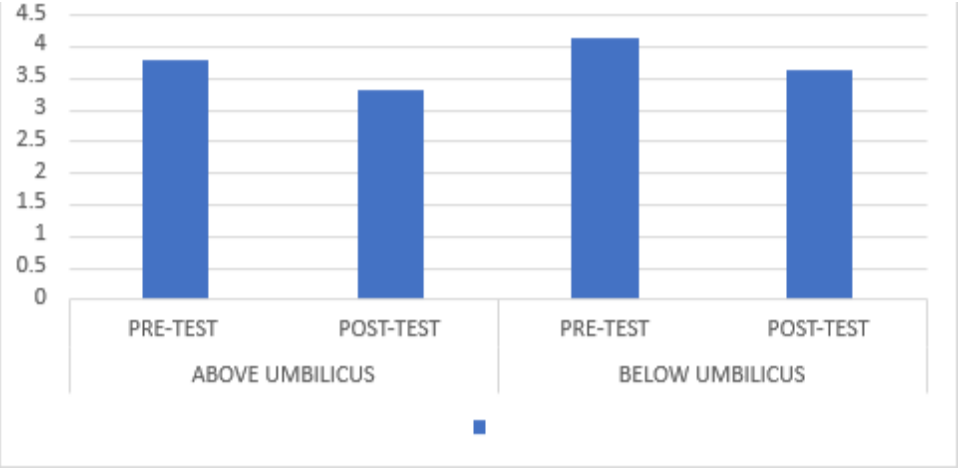
table 3: comparison of pre-test values in experimental group

GROUP	EXPERIMENTAL MEAN	T- VALUE	P- VALUE
Above umbilicus	3.3	19.56	P <0.05
Below umbilicus	3.63	4.9	P <0.05
VAS	4	10.9	P <0.05

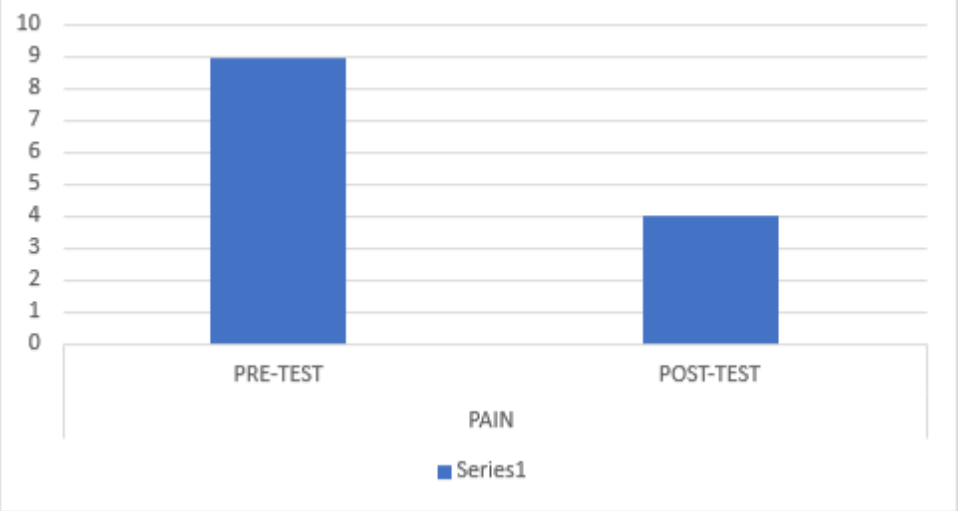
table 4: comparison of post-test values in experimental group

GROUP	EXPERIMENTAL MEAN	T- VALUE	P- VALUE
Above umbilicus	3.3	19.56	P <0.05
Below umbilicus	3.63	4.9	P <0.05
VAS	4	10.9	P <0.05

GRAPHICAL REPRESENTATION
GRAPH 1: INTER RECTI DISTANCE



GRAPH 2: PAIN



RESULTS

From the table 1, the descriptive statistics mean, standard deviation-value has been obtained using t-test of pre-test VAS and post-test VAS. The statistical results support the application of core strengthening. Also, the t- values has been obtained using t- test of pre-test and post-test of diastasis recti.
From table 2, the descriptive statistics mean, standard deviation, t- values has been obtained using t- test of pre-test VAS and post-test VAS. The statistical results support the application of core strengthening.
From table 3, the descriptive statistics of pre-test of values of VAS, diastasis recti of experimental group in the mean values VAS (8.93), diastasis recti as above umbilicus (3.76) and below umbilicus (4.11). P values VAS<0.05, diastasis recti of above umbilicus < 0.05, below umbilicus < 0.05 with the t- values and standard deviation values.
From table 4, the descriptive statistics of post-test values of VAS, diastasis rectus abdominus of experimental group in this t-test values VAS (10.9), diastasis recti as above umbilicus (19.56) and below umbilicus (4.9). P-values VAS<0.05, diastasis recti of above umbilicus < 0.05, below umbilicus <0.05, with mean values and standard deviations values.
Changes within experimental Group are analysed using paired t test and differences among pre-test and post-test.

EXPERIMENTAL GROUP

ABOVE UMBILICUS:
Mean value of pre-test 3.76 and post-test 3.30, For 14 degree of freedom and 5% level of significance, the table value is 2.145. Calculated t value is19.56, which is greater than the table value 2.145, Since alternate hypothesis is accepted there is improvement in decrease of inter recti distance.
BELOW UMBILICUS
Mean value of pre-test 4.11 and post-test 3.63, For 14 degree of freedom and 5% level of significance, the table value is 2.145. Calculated t value is 4.9 which is greater than the table value 2.145, Since alternate hypothesis is accepted there is improvement in decrease of inter recti distance.
LOW BACK PAIN

Mean value of pre-test 8.93 and post-test 4, For 14 degree of freedom and 5% level of significance, the table value is 2.145. Calculated t value is 10.9 which is greater than the table value2.145, Since alternate hypothesis is accepted there is improvement in decrease in pain intensity.

PAIRED t–test FOR DIASTASIS RECTUS ABDOMINUS ABD LOW BACK PAIN

ABOVE UMBILICUS
Values of paired t test is19.56 is greater than the table value 2.145.
Since alternate hypothesis is accepted there is improvement in decrease of inter recti distance.
BELOW UMBILICUS
Values of paired t test is 4.9 is greater than the table value 2.145
Since alternate hypothesis is accepted there is improvement in decrease of inter recti distance.
LOW BACK PAIN
Values of paired t test is 10.9 is greater than table value 2.145
Since alternate hypothesis is accepted there is improvement in decrease of inter recti distance.

DISCUSSION

This study found that diastasis recti were significantly reduced after giving core strengthening in women. Can use different technique for evaluation of diastasis recti for this study digital calliper. The study done by Cynthia Maciarello, stated that digital calliper is reliable and valid tool for measuring inter recti distance. Calliper can read the final friction of core muscles in a simple line, and it is much less expensive and more affordable. Those affected by diastasis rectus abdominus should be concerned about functional issues because it causes greater impact on their daily activities. A recent study done by Hernandez Gascon et al demonstrated that the Linea alba aponeurosis or recti fascia is most important unit for the mechanical stability. The study done by Ali A. Thabet had used digital calliper for finding inter recti distance in postpartum women [17]. some studies states that ultrasound scanning has an accurate measurement on inter recti distance than calliper [23].
Prior work has demonstrated that core strengthening improve diastasis rectus abdominus, but there is strengthening improves diastasis recti abdominus, but there is no consensus on the optimal timing, duration, frequency and types of exercise to correct these issues. In women with inter recti distance has been decreased while performing an abdominal crunch, but no data exist regarding the long-term effect of this exercise on inter recti distance. Other core-oriented exercise program of varying durations and intensities have shown favourable results regarding decreasing on and conducted in person may not be as accessible to general population [22].
In our study, the inter recti improvements at 3 weeks were statistically significant above the umbilicus at rest and below the umbilicus at rest and during contraction. Importantly participants who continued the exercise during a 3-week maintenance phase demonstrated significantly lower inter recti distance measurements at day 21 compared with day 1. Most women did not see full resolution of them inter recti distance, according to the clinical definition of a separation less than 2 cm. In addition, low back pain related were significantly improved following the 3 weeks core strengthening program.

After 3 week of core strengthening, there is decrease in low back pain and inter recti distance. This study adds to the limited studies evaluating diastasis recti abdominus in postpartum women. The core strengthening program offers advantages over a hands-on exercise program, as it can be utilized by a greater number of women and can be accessed at any time.

CONCLUSION

The result of this study shows that core strengthening is very effective in reducing diastasis recti. It helps to increase the core muscle strength and restoring postpartum abdominal efficiency. This exercise could be effective in narrowing the inter recti distance, supporting the prescription of an exercise program for reduction of diastasis recti and low back pain.
Findings from this study shows that a 3-week core strengthening program, which emphasized isometric recruitment of transverse abdominus which excluding common forward flexion exercise. Significantly decrease in inter recti distance above and the below umbilicus in postpartum women. As evidence by the larger number of women who expressed interest in this study within a short period time, diastasis rectus abdominus is a huge area of concern for postpartum women.
The core strengthening program has great potential to improve diastasis rectus abdominus in women in a time and cost-effective manner, as it can be accessed without the need for specific time commitments in person sessions.
The core strengthening program effectively improved both conditions. Our findings suggest that core strengthening exercise program offers an accessible and effective treatment strategy for postpartum women with diastasis rectus abdominus and further investigation regarding the optimal timing duration, and sequence of exercise is warranted.

LIMITATIONS AND SUGGESTIONS

- The sample size can be increased for the study
- The age group were selected from 35 to 55 years, but less than 35 years also can be selected.
- Duration of study is 3 weeks. Duration can be longer.
- Core strengthening technique is used but other techniques like tupler technique, core stability exercises also can be used [33]
- To analyse the effectiveness of pain, visual analogue scale was used. Analysis with visual analogue scale has similar effect of numerical rating scale, where they are less influenced by non-pain intensity factors [24].
- To analyse the effectiveness of diastasis recti, Ranney (25) scale is used for measurements for inter recti distance [27]. Analyse of diastasis recti can do with QUEDIA (questionnaire evaluation of diastasis recti) [45]
- To analyse the effectiveness of diastasis rectus abdominus, digital caliper device is used for measurements. Analyse of diastasis recti abdominus can also done with ultrasound also [18].

REFERENCES

1. Allen BA, Hannon JC, Burns RD, Williams SM. Effect of a core conditioning intervention on tests of trunk muscular endurance in school-aged children. The Journal of Strength & Conditioning Research. 2014 Jul 1;28(7):2063-70.
2. Amber Sayer 14 effective ab exercises to develop your core strength 2022
3. Anne Asher, CPT Pelvic Tilts for Back Pain a Simple Move with Important Benefits 2021
4. Belo M, Melo A, Delgado A, Costa A, Anísio V, Lemos A. The digital caliper's interrater reliability in measuring the interrecti distance and its accuracy in diagnosing the diastasis of rectus abdominis muscle in the third trimester of pregnancy. Journal of Chiropractic Medicine. 2020 Jun 1;19(2):136-44.
5. Cassie Shortsleeve Abs Exercises That Can Help Heal Diastasis Recti 2018
6. Doub Kova L, Andel R, Palascakova-Springrova I, Kolar P, Kriz J, Kobes's ova A. Diastasis of rectus abdominis muscles in low back pain patients. Journal of back and musculoskeletal rehabilitation. 2018 Jan 1;31(1):107-12.
7. Hacking, C. Linea alba. Reference article, Radiopaedia.org. (Accessed on 04 Jun 2022)
8. Reinpold W, Köckerling F, Bittner R, Conze J, Fortelny R, Koch A, Kukleta J, Kuthe A, Lorenz R, Stechemesser B. Classification of rectus diastasis—a proposal by the German Hernia Society (DHG) and the International Endohernia Society (IEHS). Frontiers in Surgery. 2019 Jan 28; 6:1.
9. Khan dale SR, Hande D. Effects of abdominal exercises on reduction of diastasis recti in postnatal women. IJHSR. 2016 Jun;6(6):182-91
10. Lauren Elson, MD, Understanding and improving core strength September 6, 2018
11. Leopold, Madeline BA et al, Efficacy of a Core Strengthening Program for Diastasis Rectus Abdominis in Postpartum Women: A Prospective Observational Study 2021
12. Leopold, Madeline BA et al, Efficacy of a Core Strengthening Program for Diastasis Rectus Abdominis in Postpartum Women: A Prospective Observational Study 2021
13. Leopold, Madeline BA et al, Efficacy of a Core Strengthening Program for Diastasis Rectus Abdominis in Postpartum Women: A Prospective Observational Study 2021
14. Montserrat Rejino Creation and Validation of a Questionnaire Evaluating Diastasis Recti (QUEDIA) December 2, 2020
15. Nora Tobin 6 Plank Exercises for a Stronger Core 2021
16. Owen D Williams on global burden of disease studies have defined low back pain (LBP) as “pain in the area on the...FRCSC pain medicine 9-jul-202
17. Pamela Elgen a program for preventing and healing abdominal separation caused by pregnancy.
18. Pamela Elgen a program for preventing and healing abdominal separation caused by pregnancy.
19. Petronilla OC, Uruchi EA, Francis EC, Linda UC. Assessment of diastasis recti abdominis: Clinimetric properties of four measuring instruments. Int J Health Sci (Qassim). 2023;17(6):6-1
20. Pol J Radiol. 2019; Diastasis of rectus abdominis muscles: patterns of anatomical variation as demonstrated by ultrasound
21. Roehling TL. Are Finger Width Palpation, Tape Measure, and Caliper Reliable, Valid, and Accurate to Diagnose Diastasis Recti Abdominis (DRA)? (Doctoral dissertation, Nova Southeastern University).
22. Sanjivani Ramesh Khandale1, Deepali Hande Effects of Abdominal Exercises on Reduction of Diastasis Recti in Postnatal Women 2016
23. Thabet AA, Alshehri MA. Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomized controlled trial. Journal of musculoskeletal & neuronal interactions. 2019;19(1):62.
24. Thabet AA, Alshehri MA. Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomised controlled trial. Journal of musculoskeletal & neuronal interactions. 2019;19(1):62.
25. Thabet AA, Alshehri MA. Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomised controlled trial. J Musculoskelet Neuronal Interact. 2019 Mar 1;19(1):62-8.

26. Thabet AA, Alshehri MA. Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomised controlled trial. J Musculoskelet Neuronal Interact. 2019 Mar 1;19(1):62-8.
27. Thabet AA, Alshehri MA. Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomised controlled trial. J Musculoskelet Neuronal Interact. 2019 Mar 1;19(1):62-8.
28. Thabet AA, Alshehri MA. Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomized controlled trial. Journal of musculoskeletal & neuronal interactions. 2019;19(1):62.
29. Tony Vong key principles to keep in mind strengthening your core 2021.