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# Effectiveness of NMES and Taping on Diastasis Recti in Postnatal Women

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## Abstract

The release of hormones like relaxin and estrogen occur during the gestational period and the fetal growth takes place which expands the uterus resulting in increased pressure against the abdominal wall. This causes stretching of the connective tissue, linea alba and as the weeks proceed the fetal growth occurs more and more rapidly resulting in further stretching of the connective tissue and the abdominal muscles causing an eventual decrease contraction strength weakening of muscles and can lead to a separation and widening of the space between the two rectus abdomen is muscles known as Diastasis of Recti Abdominis Muscles (DRAM). Diastasis recti is thus most common during pregnancy having a prevalence of 100% at gestational week 35 and can lead to various secondary problems like low back pain, shallow breathing and pelvic region pain. Though it is the most commonly occurring condition, it might not be painful in most cases initially and thus goes unnoticed and untreated. Purpose of the study was to compare the effects of Neuro-Muscular Electrical Stimulation (NMES) and Kinesiotaping along with core stabilization exercises on diastasis recti in postnatal women, in terms of inter recti distance, abdominal muscle strength and low back pain. A total of 40 women with significant diastasis recti, 6 weeks postnatal, participated in the study. They were equally divided with random selection of 20 subjects in two groups each, Group A was treated with NMES and Group B received Kinesiotaping and both the groups in addition received core stabilization exercises. The results revealed very significant improvement in both the groups in all the measured parameters, ($p<0.05$). However, the intergroup comparisons showed significant improvement in all the measured parameters in group A ($p<0.05$). Thus, the study concluded that NMES along with core stabilization exercises is effective in recovery of diastasis recti and increasing abdominal muscle strengthas well as improvement in its complications like low back pain.

**Keywords:** Core Stabilization Exercises, Diastasis Recti, Inter Recti Distance, Kinesiotaping, Low Back Pain, Neuromuscular Electrical Stimulation

## 1. Introduction

Diastasis recti can be defined as a partial or complete separation of the right and left rectus abdominis muscles. Thus, widening the space between the two and resulting in bulging of the abdomen. The release of hormones like relaxin and estrogen occur during the gestational period and the fetal growth takes place which expands the uterus resulting in increased pressure against the abdominal wall. This causes stretching of the connective tissue, linea alba and as the weeks proceed the fetal growth occurs more and more rapidly resulting in further stretching of the connective tissue and the abdominal muscles causing an eventual loss of their force vector and reduction in their strength of contraction thus leading to the separation of the rectus abdominis muscles[1].

Pregnancy is thus the most common cause of Diastasis of the Rectus Abdominis Muscle (DRAM), occurring with a prevalency of 100% at the 35$^{th}$ week of gestation and on an average affecting about 66% of women and may continue for about 6 weeks to 6 months postnatally[1,2]. Though it is the most commonly occurring condition following pregnancy, it's not painful in most cases and thus often goes unnoticed and untreated which further gives rise to increasing separation of the rectus muscle and discomfort associated with it[3].

The thoracolumbar fascia, core muscles and the abdominal muscles help in the stabilization of the lumbar spine and support

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the pelvis however, due to their reduced strength and ability to support and maintain the spine occurring in diastasis recti leads to secondary problems like low back pain. Furthermore, due to decreased strength and integrity of the muscles of the back, abdominal muscles and core instability other muscles tend to work more and more in order to overcome the loss leading to increase in strain as well and also leading to pain in the pelvic region, bad postural attitude and shorter breaths[4-6]. A significant increase in joint laxity is also seen during the last trimester of pregnancy and multiparous women show greater laxity than the primiparous women[7-9].

Postnatal exercises are beneficial for the mother as well as the baby as it improves aerobic fitness and the overall cardiac health, helps in weight reduction and also promotes milk production thus, improving the breastfeeding process. Along with those strengthening of the core musculature during the gestational period as well as in the postnatal period is very beneficial in the reduction of diastasis recti and the further secondary problems associated with it[1]. Studies reveal that strengthening exercises are effective in decreasing postural instability and also minimizing the low back pain at some level, increasing the tone of muscles and thus beneficial in the improvement and treatment of DRAM[2,10,11] however guidelines in the literature regarding how large of a diastasis can be treated conservatively with exercises are lacking[12].

Studies reveal that spontaneous reduction of diastasis of the rectus abdominis muscle is very rare and physiotherapy is the first treatment step, but the evidence on which regimen to use is lacking and its success rates are not stated[13,14].

Other physiotherapy techniques known beneficial in reducing diastasis are bracing, Kinesiotaping and Neuromuscular Electrical Stimulation (NMES), however as mentioned above which technique is more beneficial and helps in which aspect of reducing diastasis is not known[1,8,15,16,].

Kinesiotaping is a technique used in rehabilitation and is an adjunct treatment option for other musculoskeletal impairments it includes flexible water-resistant elastic bands applied on the patient's body which stimulates in a pain-free and non-invasive way. This indeed helps in muscle function correction as it acts on weak muscles and increases their strength and also causes neurological suppression resulting in pain reduction, increased blood circulation and repositions the sublaxed joints as it helps in alleviating the muscle tension which helps returning the muscle and fascial functions[5,17]. It stimulates the mechanoreceptors by its application on the skin resulting in muscle fascilitation[18]. Women with diastasis recti generally do not perceive pain at rest however discomfort, pain, instability of the corset and bulging of the abdominal wall are the symptoms which appear while performing physical activities thus, kinesiotaping helps relieving this discomfort while performing activities and prevents abdominal bulging while strengthening the abdominal muscles[19].

When a muscle contraction is elicited by applying an electric current to the subject the technique is known as NMES. Thus results in strengthening of the muscles and abdominal muscle strengthening helps recovering and treating diastasis and its secondary effects as well[1]. However studies recommend exploring the potential benefits of NMES on abdominal strength in those individuals who have low back pain and are thus unable to perform the traditional or conventional abdominal exercises[20].

According to the available literature, there have been studies on effect of NMES on improving abdominal strength in women with diastasis recti and effect of kinesiotaping on reduction of diastasis and back pain in those women, however the effect of these techniques on all the parameters which are the inter recti distance, strength of abdominal muscles and its effect on low back pain and comparing both these techniques on the basis of these parameters have not been studied yet.

Thus this study focuses on comparing the effect of both these techniques in terms of improvement and reduction of diastasis recti in postnatal women.

## 2. Materials and Methods

This study included a total of 40 postnatal women who had a normal vaginal delivery (FTND) and the study design used was of the randomized control trial. The study was approved by the Institutional Ethics Committee of Krishna Institute of Medical Sciences "Deemed to be University", Karad. The inclusion criteria were women having a significant DRAM evaluated at any of the three levels throughout the extent of linea alba i.e., above, at and below the umbilicus measuring equal to greater than 2.5cm, women at 6 weeks postpartum and the subjects who had a parity of four and less than four were included in the study. Women with other comorbidities like hypertension, diabetes and any other pregnancy related complications, grand multiparous women and women who have undergone caesarean section previously or presently were excluded from the study[1].

The simple randomized method was used to divide all the 40 subjects randomly into 2 equal groups of 20 each. Group A as well as Group B both received conventional core stabilization exercises. The protocol for Group A included the application of NMES along with core stabilization exercises and Group B received taping along with core stabilization exercises. A total 4 week protocol was followed including 3 sessions every week for both the groups. All the women were clearly explained and demonstrated about the procedures to be performed and proper demonstration of the strengthening exercises was given to each and every women.

Evaluative procedures:

1. Inter Recti Distance (IRD): The inter recti distance measurement was done by the use of a skin tone caliper. The IRD was measured at three levels both pre and post protocol, that is 4.5cm above and below the umbilicus and at the umbilicus[3,19,21].
2. Manual Muscle Testing (MMT) of abdominal muscles: The strength of the rectus abdominis muscle was recorded on a 0-5 point scale using manual muscle test suggested by Dr. Lovett. The patients were positioned in a supine, crook-lying attitude with the arms straight by the side. The subjects were directed to lift and reach upwards till the scapular lower end level and if the subject was able to achieve and hold this position successfully then was asked to perform the next position by crossing the hands over the chest and then leaning forward and lifting the scapula off the table. After the patient achieved this position successfully forward reaching with hands crossed and supporting at the back of the head was performed. The scores were recorded based on the position that the patient could achieve and sustain successfully i.e. scores 3, 4 and 5 respectively for the above mentioned positions[18,22].
3. Roland Morris Disability Questionnaire (RMDQ): the questionnaire was used to measure the level and severity of disability occurring due to low back pain reflected by higher numbers on a 24-point scale. The questionnaire was taken at the beginning and after completion of the protocol and the clinical improvement was calculated based on the scores[17].

Treatment procedure:

1. Neuro-Muscular Electrical Stimulation (NMES): Electrical stimulation was applied followed by core stabilization exercises only in subjects included in Group A. the subjects were explained to relax their abdominal muscles while application. Stimulation was applied by four large rectangular electrodes placed over the origin (pubic crest) and insertion (xiphoid process) of the rectus abdominis muscles bilaterally. Straps were used to fix the electrodes in place. A frequency of 80 pulses/min and with a pulse width of 0.1-0.5ms, were the parameter settings applied in this study. The total time for the application of stimulation was 30mins and until a good enough observable muscle contraction was achieved a gradual increase in intensity was performed[1,23].
2. Kinesiotaping: Kinesiotape was applied for the subjects included in Group B followed by core stabilization exercises. Women were instructed to achieve the supine lying position and a tape of 2 inches width was applied using the criss-cross technique beginning from one side and at the lower border of the thoracic cage and extending downwards and laterally to the other side. A total of 8 such strips of 2 inches width were applied in the criss-cross manner extending till the symphysis pubis using light to moderate tension[8,24].
3. Core stabilization exercises: This exercise protocol was given to the subjects in Groups A as well as to the subjects group B and the subjects were given clear demonstration of the exercises. 20 repetitions for each exercise were performed and increased by 4 repetitions every week throughout the 4 week intervention program. Following exercises were performed- Head lift, Head lift with pelvic tilt, Drawing in maneuver/isometrics (5 sec hold), Crunches, Reverse Crunches, Reverse trunk rotation, U-seat exercise[1,25,26,27,28].

## 3. Results

The patients who finished a complete session of 4 weeks for them analysis was made and on whom complete pre and post assessments were performed. Group A and Group B both consisted of 20 subjects each and the intragroup analysis for both the groups was performed using the Paired 't' test. A highly significant clinical improvement was revealed in each of the groups in the intergroup comparisons performed on IRD at all the three levels as well as on other outcome measures i.e. MMT and Roland Morris Disability Questionnaire ($p<0.05$), however a greater improvement in Group A in all the measures ($p=0.0001$).

The unpaired 't' test was performed for the intergroup analysis. The inter recti distance above umbilicus between both the groups revealed a very significant difference ($p=0.0067$) in the post intervention analysis also at umbilicus a highly significant difference was seen between both the groups ($p=0.0003$) and below umbilicus a highly significant difference between the groups ($p=0.0001$) was found. The intergroup comparison of MMT also revealed a very significant difference ($p=0.0048$). The post intervention analysis of Roland Morris Disability Questionnaire showed significant difference between both the groups ($p=0.0319$) (Table 1-3 & Graph 1-3).

**Table 1.** Clinical baseline measures of the subjects

| Parameters | Group A | Group B | p-value |
|---|---|---|---|
| IRD above umbilicus | 3.30±0.47 | 3.15±0.67 | 0.4180 |
| IRD at umbilicus | 3.50±0.51 | 3.50±0.51 | 0.999 |
| IRD below umbilicus | 3.05±0.51 | 3.25±0.55 | 0.2409 |
| MMT | 2.50±0.51 | 2.95±0.60 | 0.0154 |
| RMDQ | 9.50±3.45 | 8.90±3.09 | 0.5389 |

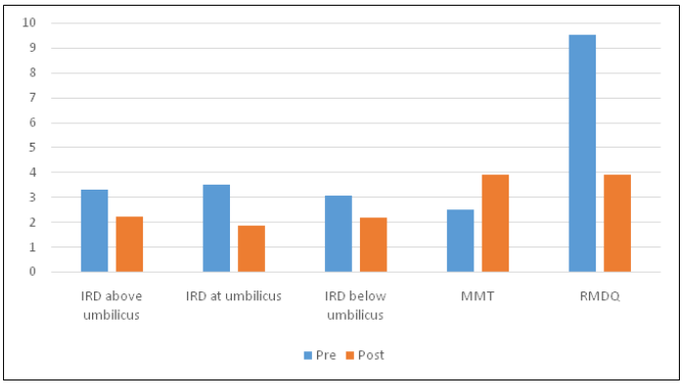
[IRD - inter recti distance, MMT - manual muscle testing, RMDQ - Roland Morris Disability Questionnaire]

**Table 2.** Outcome measures pre and post intervention in both groups

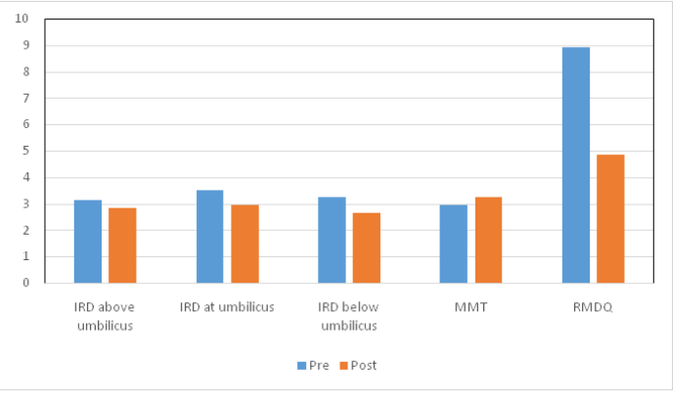
| Parameters | Group A | | Group B | |
|---|---|---|---|---|
| | Pre | Post | Pre | Post |
| IRD above umbilicus (cm) | 3.30±0.47 | 2.20±0.77 | 3.15±0.67 | 2.85±0.67 |
| IRD at umbilicus | 3.50±0.51 | 1.85±0.75 | 3.50±0.51 | 2.950±0.83 |
| IRD below umbilicus | 3.05±0.51 | 2.15±0.67 | 3.25±0.55 | 2.65±0.88 |
| MMT | 2.50±0.51 | 3.90±0.78 | 2.95±0.60 | 3.25±0.74 |
| RMDQ | 9.50±3.45 | 3.9±2.63 | 8.90±3.09 | 4.85±3.18 |

**Table 3.** Post intervention outcome measures for both groups

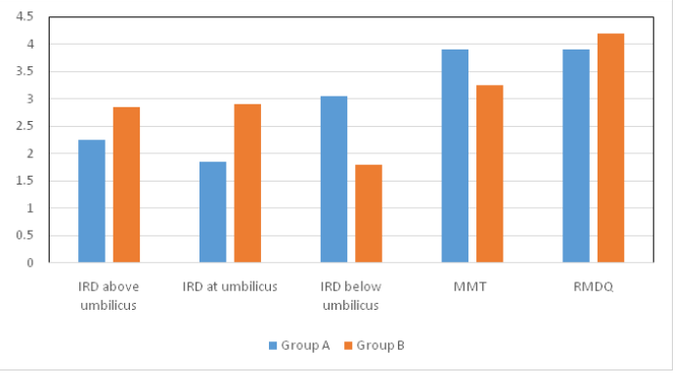
| Parameters | Group A | Group B | Mean difference | t-value | p-value |
|---|---|---|---|---|---|
| IRD above umbilicus | 2.25±0.79 | 2.85±0.67 | 0.65 | 2.60 | 0.0067 |
| IRD at umbilicus | 1.85±0.74 | 2.90±0.79 | 1.05 | 4.33 | 0.0003 |
| IRD below umbilicus | 3.05±0.51 | 1.80±0.70 | 0.50 | 12.58 | 0.0001 |
| MMT | 3.90±0.78 | 3.25±0.72 | -0.65 | 2.729 | 0.0048 |
| RMDQ | 3.90±2.63 | 4.20±3.07 | -2.10 | 2.23 | 0.0319 |




**Graph 1.** Outcome measures pre and post intervention in Group A.




**Graph 2.** Outcome measures pre and post intervention in Group B.




**Graph 3.** Post intervention outcome measures for both groups.

## 4. Discussion

The study aimed at finding the effect of NMES and Kinesiotaping along with core stabilization exercises on Diastasis recti in postnatal women. Postpartum Females who have gave birth Through Normal vaginal Delivery (FTND) and have significant diastasis recti of more than 2.5cm, 6 weeks postpartum were included in the study.

Subjects between the age group of 20 to 30 years were studied with a total of 20 subjects included each of the groups. Group A was treated with NMES followed by core stabilization exercises and Group B was treated with Kinesiotaping along with core stabilization exercises. Many research studies state that voluntary exercises are necessary for the improvement in muscle strength and in increasing the tone of the muscles, helps in facilitation, stabilization and concentric activation of the muscle and thus must be applied in combination with the techniques for achieving better clinical improvement in the subjects[1,2,19,27,29]. Thus this study included the application of NMES and Taping along with core stabilization exercises given to both the groups.

Applying a long duration interrupted direct current i.e. application of faradic current to a motor nerveproduces a muscle contraction of the muscle which the stimulated nerve supplies which is known as Neuromuscular electrical stimulation[3]. Stimulation is applied using pad electrodes placed over the origin and insertion of the rectus abdominis muscle. The results showed that Group A had significant intragroup improvement in all the parameters and at all the three levels of the inter recti distance. The application of kinesiotape over the rectus abdominis muscle for treating diastasis is a fairly new technique. Studies reveal that kinesiotaping mainly helps in reducing the intra-abdominal pressure by supporting the abdominal musculature and bracing it together and can thus help enhance the effect of exercises by stimulating muscle facilitation and stabilize and prevent any further separation of the diastasis while strengthening the muscles[5,18,24]. The study supported the above findings, as the results revealed a significant intragroup improvement at all the three levels of inters recti distance and other parameters in Group B and a significant improvement in low back pain especially was found.

The results concluded significant intergroup improvement in the inter recti distance, strength of the muscle as well as in reduction of low back pain in Group A. Thus, though there was significant intragroup clinical progress in both the groups, group 'A' revealed greater improvement in all the measured parameters. Studies support the above findings by suggesting that application of electrical stimulation along with abdominal strengthening exercises given in combination help improving the muscle strength faster and thus promotes recovery[3,23]. A study by Kamel DM, Yousif AM also reveal that application of NMES helps in the recruitment of the deep muscle fibers as it activates the type II i.e., the large nerve fibers at relatively low intensities. Thus the repetitive application of electrical stimulation helps recruiting the non-contractile tissues and increases muscle contraction increasing the strength of the muscles eventually[1,3].

Thus it was concluded that application of NMES along with exercises helped in greater improvement of the muscle strength and thus promoted a faster recovery in the subjects, reducing the inter recti distance and low back pain. Though Group A showed greater clinical improvement, the reduction in low back pain and relief of discomfort was reported by subjects in Group B immediately or within the first week. This was found to be as a result of correction of muscle function and balancing the intra-abdominal pressure immediately achieved through muscle guarding due to the application of kinesiotaping. However, the greater clinical improvement at the end of the complete 4 week treatment session in Group A was found owing to the gradual increase in muscle strength thus relieving the symptoms and greater clinical improvement and recovery in subjects with diastasis recti. Thus, even though it was concluded that NMES showed better clinical improvement it is found that Taping and NMES can both be used in combination for management of diastasis and would be an effective treatment measure. Kinesiotaping could be used in the initial period of treatment for immediate relief of symptoms and stimulating muscle facilitation followed of the application of NMES or could also be used in the later period of treatment following NMES when adequate muscle strength has been achieved and can be applied then continued along with the exercises.

There are a few limitations found in this study that could be considered for the future research which are the inclusion of women who underwent cesarean section as these studies only included women with normal vaginal delivery. The study performed was limited to a small geographical area and any objective assessment tool for the measurement of muscle strength was not used, thus a more reliable tool or device can be used in the future studies. Comparison between the parameters of the primiparous and multiparous women was not taken into consideration in this study.

## 5. Conclusion

The study revealed a significant improvement in the inter recti distance above, below and at umbilicus in both the groups as well as a significant change in muscle strength and low back pain was found in both groups. However, application of NMES along with core stabilization exercises was found to be more effective on all the outcome measures but it can be concluded that both the techniques can be used in combination with each

other for targeting improvement in specific parameters and can yield better recovery in subjects with diastasis recti.

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