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DOES THE PARTIAL SIT-UP EXERCISE REDUCE THE POSTPARTUM INTER-RECTUS ABDOMINIS DISTANCE?

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SUMMARY

Diastasis recti abdominis (DRA) is a pregnancy and postpartum condition characterized by an augmented inter-rectus distance (IRD) in consequence of a midline separation of both rectus abdominis (RA) muscles along the linea alba (LA). The effect of the abdominal-strengthening exercises on IRD reduction is unclear. Thus, the purpose of this study was to analyze the effect of one modality of abdominal muscles contraction, the *partial sit-up* exercise on postpartum IRD. Ultrasound images from the abdominal wall of 38 postpartum women were used to measure IRD in a supine rest position and at the end position of a *partial sit-up* exercise. Results revealed a significant differences in the IRD measured in a supine rest position ($M = 26.41 \text{ mm} \pm 9.41 \text{ mm}$) and at the end position of a *partial sit-up* exercise ($M = 22.07 \text{ mm} \pm 7.38 \text{ mm}$), $t(37) = -3.11$, $p < .000$. The isometric contraction of the abdominal muscles during a *partial sit-up* was enough to induce a significantly reduction in postpartum RA separation. Further research is needed to analyze the effect of isotonic contraction namely on the subsequences phases of the sit-up exercise and/or the contribution of the deepest abdominal muscles namely the transversus.

INTRODUCTION

During postpartum period many women continue, or even begin, abdominal strength exercise programs in order to restore their abdominal figure and fitness. However, prescription of these abdominal exercise programs in postpartum are not based on evidence and very little literature exists about the effect of exercise on abdominal muscles morphological during and after pregnancy. It is recognized that pregnancy imposes substantial morphological changes in the abdominal muscles with implications on functional capacity of women during the postpartum period [3, 5]. A muscle that undergoes changes during pregnancy is the rectus abdominis (RA) which extends along the entire length of the anterior abdomen, from the xiphoid process to the pubic symphysis. As the fetus grows, the two muscle bellies of the RA, connected by a fascia tendon, the linea alba, elongates and curve round as the abdominal wall expands, with most separation occurring at the umbilicus [1, 4, 5]. This gap, the inter-recti distance (IRD), may vary from 2 to 3 cm wide and 2 to 5 cm long,

longitudinally the whole length of RA along 20 cm [3]. The augmented IRD, often referred as *diastasis abdominis* [1, 3] is described as a change in the abdominal musculature, namely in the linea alba and RA sheath, with onset in the last trimester of pregnancy and whose peak of incidence occurs immediately after birth.

Most of postpartum women, moved mainly by cosmetic reasons, are invited to engage specific abdominal exercise programs to reduce the augmented IRD. The rationale behind these strengthening programs is the assumption that the contraction of all abdominal muscles will reduce the abdominal horizontal diameter in such a way that a horizontal force will be generated producing the approximation of both RA, particularly at umbilicus level. This horizontal force is the resultant of the overall action of the internal and external oblique in conjunction with the transversus muscles. Because these muscles use the lumbar column attachment as fixed sites to their actions, is not guaranteed that the horizontal tension will produce an approximation of both RA. Tension generated by the deep abdominal muscles and applied to the RA sheath [9] could drag RA belies direction to each side of the vertebral column, increasing inter-rectus distance.

Thus, the main purpose of this study was to analyze the effect on IRD produced by the isometric contraction of both RA muscles at the end-position of the *partial sit-up* exercise. We hypothesized that the augmented postpartum IRD will be reduced by the isometric contraction of both RA muscles. Knowledge of the abdominal muscles morphological adaptations in postpartum women and the relationship between muscle structural changes and functional ability is required in order to develop specific abdominal strength exercises programs for prevention or resolution of IRD incidence in postpartum women.

METHODS

An ultrasound scanner (GE Logic-e; 4-12 MHz, 39 mm linear transducer; B-mode) was used to record images from both RA on 38 postpartum primiparous women (Age: 26.5 ± 7.38 years; IMC: 24.13 ± 5.38 %) in two conditions: supine rest position and at the final position of the *partial sit-up* exercise. The transducer was placed 2 cm above the

umbilicus, transversely along the midline of the abdomen. The IRD was measured offline by the same investigator blinded to the result using a customized Matlab[®] code (Image Processing Toolbox, Mathworks) assuming each ultrasound images as a pixel based 'xy' coordinate system. The contour of both RA was identified by ultrasound image segmentation using a parabola-like-curve fit approach. The inflexion point of the interpolated parabola-like-curve was overlapped on the original ultrasound image, to guide the examiner on the identification of the end points of the linea-alba and improve the accuracy of IRD measurement. A pairwise t-test was used to compare IRD on both experimental conditions (rest and under isometric contraction) using specific software (SPSS-v19) and a significant level of $P < 0.05$.

RESULTS AND DISCUSSION

Results revealed a significant differences in the IRD measured in a supine rest position ($M = 26.41 \text{ mm} \pm 9.41 \text{ mm}$) and at the end-position of the *partial sit-up* exercise ($M = 22.07 \text{ mm} \pm 7.38 \text{ mm}$), $t(37) = -3.11, p < .00$.

The available knowledge suggests that an augmented IRD is a common condition in the period immediately after birth with a natural resolution during the postpartum period [6]. A partial IRD resolution was reported by 4 weeks [5] and 8 weeks [3] after birth. However, for many women the IRD does not resolve spontaneously during the postpartum period, or even on months or years after birth [3]. Although, remains unclear what are the functional implication of RA separation, some authors suggested that an augmented IRD could contributing to pelvic instability and back pain by reducing the capacity of the abdominal muscles to generate force [5, 7].

Abdominal muscle exercise is encouraged during postpartum period to recover the effects of pregnancy on women's anterior abdominal wall and reducing the IRD. However, no available information exists in literature about the effect of abdominal muscle contraction on RA separation, in postpartum women. The results of our study indicate that the postpartum IRD significantly decrease when a *partial sit-up* exercise is performed, i.e. when the abdominal muscles generate isometric force. These results give scientific support for the use of the abdominal strengthening exercises as a contributor factor for IRD reduction in postpartum women. An abdominal strengthening program must also consider the relationship between IRD and the abdominal muscles capacity to generate force, especially during trunk flexion actions.

The results of our study must be restricted to primiparous women with less than 6 months after birth period. In fact, the effect of some predisposing factors to an augmented IRD were not analyzed such as maternal age (up to 34 years), larger babies, greater weight gain during pregnancy, caesarean section, multiple gestations, large or excess amount of fluid in the uterus, a weak abdominal musculature or a long labor period with accompanying pushing which creates excessive intra-abdominal pressure [2, 3, 7]. The effect of exercise on postpartum IRD observed in our study could be related with the fact that all postpartum women had

mild IRD, i.e. less than 30 mm in rest condition. We should keep in mind that clinically the criteria for abdominal surgery recommendation is defined for IRD higher than 42.7 mm, measured by computerized tomography [8] or by ultrasound image [10] at umbilicus level. Further research is needed to clarify the effect of exercise on postpartum IRD highest than 20 mm and lowest than 42.7 mm.

CONCLUSIONS

The isometric contraction of the abdominal muscles during a *partial sit-up* exercise was enough to induce a reduction in postpartum RA separation. This provides evidence that the IRD is reduced by abdominal muscles contraction, particularly the RA muscles. This information is essential to the effectiveness of any abdominal-strengthening exercises program focus on IRD reduction.

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