

## CAN THE ABDOMINAL AND PELVIC MUSCLE TRAINING TRIGGER THE CO-ACTIVATION BETWEEN THE TRANSVERSUS ABDOMINIS / INTERNAL OBLIQUE MUSCLE AND THE MUSCLES OF THE PELVIC FLOOR DURING PREGNANCY AND POSTPARTUM?

### Hypothesis / aims of study

During pregnancy, adaptations lead to several biomechanical changes for compensating the center of gravity, which may trigger changes in the dynamics *abdominopelvic*. This is repeated abruptly after delivery, since the stabilizing muscles of the spine undergoes a series of changes during the puerperium.

The abdominal muscles are stretched, with consequent loss of strength and ability of static and dynamic stability. The musculoskeletal and postural adjustments triggered during pregnancy stretch and during postpartum period may provide excessive strain, with changes in force vectors, loss of contractility, resulting in functional impairment.

Therefore, this study aimed to investigate whether the abdominal and pelvic muscle training can trigger the co-activation between the muscles transversus abdominis / internal oblique (Tra / IO) and the pelvic floor muscles (MAP) during pregnancy and postpartum.

### Study design, materials and methods

This is a clinical, controlled, prospective and blind trial. The sample consisted of 33 primiparous women with mean age of 22.68 ( $\pm 5.51$ ) years, divided into three groups: (GG) group of pregnant women, gestational age of 28.3 ( $\pm 2.95$ ) weeks ( $n = 13$ ), (GPV) Group of women with mean of 49.3 ( $\pm 5.84$ ) days after vaginal delivery with right mediolateral episiotomy ( $n = 10$ ), (GPC) group of women with a mean of 46.3 ( $\pm 3.60$ ) days after delivery cesarean section. The evaluations were performed by a physiotherapist who was unaware of the research objectives. All patients were evaluated before and after the treatment protocol and had no co-activation between muscles Tra / IO and MAP during the initial evaluation.

The contractility of muscles Tra / IO and MAP was evaluated by electromyography (EMG<sup>®</sup> System, Brazil - Model 400C), making use of surface electrodes (disposable, 3M<sup>®</sup>) placed in the region of the muscle Tra / IO (two inches from crest iliac, towards the pubic area) and endovaginal *probe* (Physio-Med Services<sup>®</sup>) to verify the contractile activity of pelvic floor muscles. To investigate the behavior of the muscles, there were three maximum voluntary contractions of MAP, followed by three maximal voluntary contractions of Tra / IO, with concurrent electromyographic record. For analysis of EMG data, we selected five seconds of each contraction recorded and performed an average of three RMS (*Root Mean Square*) for each patient.

The TMAP protocol was developed and supervised by the principal investigator and consisted of ten sessions, at home, held three times a week, lasting sixty minutes each.

The exercises began in the supine position, progressing to sitting and standing and were based on TMAP using the Swiss Ball (fast-twitch and slow) associated with breathing exercises and postural care.

To compare the measures, taking into consideration the evaluated and the groups, we used analysis of variance (ANOVA), *Spearman* Linear Correlation Coefficient with significance level of 5%.

### Results

The groups were homogeneous in all sociodemographic variables. Most women were white, married, in high school or middle school either complete or incomplete, and family income  $\geq 2$  minimum salary.

Regarding the analysis of the effectiveness of abdominal and pelvic muscle training on contractility of muscles MAP and Tra / IO alone, we observed a significant increase in contractility of both muscles (MAP  $<0.0001$ ; Tra / IO:  $p = 0.008$ ), regardless the group. However, the group of elective cesarean section after labor has demonstrated increased muscle contractility Tra / IO, as compared to other groups ( $p = 0.003$ ).

By investigating the behavior of muscles Tra / IO and MAP, while the post-training, there was significant increase in contractility of MAP ( $p = 0.002$ ) during maximal voluntary contractions of Tra / IO. However, there was a marked increase in contractility of Tra / IO during maximal voluntary contractions of MAP ( $p = 0.1$ ), after training for all groups.

This demonstrates that the training did not promote co-activation of muscles Tra / IO when the maximum contraction of MAP is performed, but the isometric abdominal exercise (contraction of Tra / IO) recruits the MAP.

### Interpretation of results

Gatti et al. (2005) (1) reported that the exercises on unstable surfaces, increase the activation of the stabilizing muscles of the trunk, including the deep muscles, pelvic floor and Tra / IO. Thus, the instability caused by the Swiss ball during the exercises, the neuromuscular system works to a greater extent than traditional methods on a stable surface. The movements provided by the Swiss ball exercise are still capable of deep and superficial muscle structures, besides providing the physical welfare stance, which could alleviate the complaints of pregnancy and puerperium.

Several authors have been researching the behavior of muscle MAP and muscle Tra / IO, saying they had co-activation between them in young asymptomatic, however, no studies were found after performing strength training, especially during pregnancy and puerperium.

In assessing the co-activation between muscles Tra / IO and pelvic floor, Pereira (2010) (2) found significant correlation of the muscles Tra / IO during pelvic floor exercises and vice versa, in nulliparous women, but there was no co-activation between these muscles, or pregnancy and postpartum.

Our study confirms these findings, since, during the initial evaluation (pretreatment), all pregnant and postpartum women had no co-activation between muscle Tra / IO, when the maximum contraction of MAP was performed.

However, the proposed training protocol did not elicit the co-activation of muscle Tra /IO, when the maximum contraction of MAP was performed. In contrast, after training, co-activation of MAP during maximal isometric contraction of muscles Tra / IO were observed. According to Béziers and Piret (2002) (3), the transverse abdominus muscle fibers have extended the transverse perineal muscle, which could explain those findings. However, we emphasize the importance of prescribing exercise isometric abdominal (Tra / IO), in order to aid recovery from abdominal and pelvic enclosure, provided that prescribed with caution and supervision.

#### Concluding message

Kinesiotherapy caused a significant increase contractility of the pelvic floor muscles and the abdomen (transverse abdominus / internal oblique) in isolation, in pregnant and postpartum women. When comparing the types of delivery, it was found that the post-cesarean delivery was associated with improved activation of the muscles of the abdomen after vaginal delivery. The supervised training of the muscles of the pelvic floor and abdomen during pregnancy and postpartum favored also the co-activation of the pelvic floor when the isometric abdominal exercise was conducted. However, no co-activation of the abdomen when the pelvic floor exercise was conducted.

#### References

1. Contreras 1994 Gatti R, Corti M, Barbero M, Testa M. Electromyographic activity of the rectus abdominis muscle during exercise performed with the ABSlider. J Sport Sci Health 2006; 1(3):109-12.
2. Pereira LC. Impacto da gestação e do parto na co-ativação entre os músculos transverso do abdômen/oblíquo interno e o assoalho pélvico: avaliação eletromiográfica. Tese de Mestrado. Campinas (SP): Universidade Estadual de Campinas; 2010.
3. Piret S, Béziers MM. A coordenação motora: aspecto mecânico da organização psicomotora do homem. São Paulo (SP). Summus; 2002.

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| <b><i>Is this a clinical trial?</i></b>                                      | <b>Yes</b>                                                                                                                                           |
| <b><i>Is this study registered in a public clinical trials registry?</i></b> | <b>Yes</b>                                                                                                                                           |
| <b><i>Specify Name of Public Registry, Registration Number</i></b>           | <b>Study approved by the Ethics and Research - Pontificia Universidade Catolica de Minas Gerais campus Poços de Caldas (SEAC 0306.0.213.213-07).</b> |
| <b><i>Is this a Randomised Controlled Trial (RCT)?</i></b>                   | <b>No</b>                                                                                                                                            |
| <b><i>What were the subjects in the study?</i></b>                           | <b>HUMAN</b>                                                                                                                                         |
| <b><i>Was this study approved by an ethics committee?</i></b>                | <b>Yes</b>                                                                                                                                           |
| <b><i>Specify Name of Ethics Committee</i></b>                               | <b>Study approved by Ethics and Research - Pontificia Universidade Catolica de Minas Gerais campus Poços de Caldas.</b>                              |
| <b><i>Was the Declaration of Helsinki followed?</i></b>                      | <b>Yes</b>                                                                                                                                           |
| <b><i>Was informed consent obtained from the patients?</i></b>               | <b>Yes</b>                                                                                                                                           |