

IS THERE A DIFFERENCE IN THE CO-ACTIVATION OF MUSCLES TRANSVERSUS ABDOMINIS / INTERNAL OBLIQUE AND PELVIC FLOOR DURING PREGNANCY?

Hypothesis / aims of study:

The musculoskeletal capsule is formed by abdominal pelvic, lumbar vertebrae, the deeper layers of muscle multifidius, respiratory diaphragm and transversus abdominis. The balance and maintenance of the stability of the spine and pelvis are due to co-activation of deep and superficial muscles that act across the trunk. Sapsford et al. (2001) (1), Neumann & Gill (2002) (2) and Bø (2004) (3) have demonstrated the recruitment of the transversus abdominis muscles / internal oblique (Tra / IO) during contractions of the pelvic floor muscles (MAP) in young individuals, states cannot be held an effective contraction of the pelvic floor during the relaxation of the deep abdominal muscles. This fact suggests that the abdominal muscles have strong influence on the performance of the pelvic floor. Thus, this study aims at evaluating, through surface electromyography, the female co-activation during abdominopelvic exercises of maximal voluntary contraction of Tra /IO and MAP in primigravid pregnant women compared to nulliparous women.

Study design, materials and methods:

Clinical, prospective, observational and controlled, comprising 45 women, mean age of 24.52 (\pm 4.6) years and mean body mass index of 24.62 (\pm 2.45). The volunteers were recruited in the Health Programs of the National Health System (SUS), the city of Poços de Caldas (Minas Gerais, Brazil) and divided into two homogeneous groups (Hartley test $H_c = 3.47$ for age and $H_c = 2, 14$ for BMI): (G1) 20 nulliparous women without symptoms of dysfunction of the MAP (G2) 25 primiparous pregnant women with mean gestational age of 30.49 weeks. Not included were women who had: prior abdominal or pelvic surgery, pelvic organ prolapse, diabetes, hypertension, neurological abnormalities, myopathy, chronic lung diseases, presence of urinary tract infection; physically active, high impact training of the pelvic floor and / or Training the abdominal muscles, body mass index (BMI) ≥ 30 kg/m². Surface electrodes (disposable, 3M ®) were placed on the muscle region Tra / IO is two centimeters of the iliac crest, towards the pubic region, with the patient standing and prior sanitation of the abdominal region with 70% alcohol. The evaluation of muscle contractility of the muscles of the MAP and Tra /IO was performed with the patient supine, knees and hips flexed and feet flat on the table after placement of the transvaginal probe (Physio-Med Services®). The probe was inserted manually by the researcher, with the aid of allergy KY gel (Johnson's & Johnson's® - Brazil), and metal parts contact with the side walls of the vagina. Both sensors (abdominal and perineal) were connected to the electromyography (EMG® System, Brazil, model 400C) that transmitted their electrical signals in micro-volt (microvolts) to a notebook (Hp® Pavilion TX2000 model), where the data was stored software provided by the manufacturer for analysis.

The evaluation protocol electromyographic (EMG) consisted of three request isometric, voluntary, maximal pelvic floor, recorded by the endovaginal probe (channel 1). Contraction of the pelvic floor muscles has been previously taught to the patient requesting that she pressed the probe cranially and observed its contraction on the computer screen. With each contraction requested, was performed with a rest period twice the time of contraction performed in order to avoid muscle fatigue.

Later they were asked three isometric contractions, voluntary maximal muscle Tra /IO (channel 2). For these contractions, the patients were instructed to contract the lower abdomen without any motion during the expiratory phase. For the analysis of co-activation between the muscles studied were recorded electrical activity from both muscles (MAP and Tra /IO), simultaneously. All activities were supervised by the same researcher. During the 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. We used the same parameters for both muscles - MAP and Tra /IO.

The statistical test used for data analysis was performed electromyographic analysis of variance (ANOVA) with application of Orthogonal contrasts test with a significance level of 1%.

Results:

The nulliparous group showed both co-activation of muscles Tra/IO to achieve maximal voluntary contraction of the MAP, the co-activation of muscles in the MAP, to achieve maximal voluntary contraction of muscles Tra/IO. However, groups of pregnant women showed no significant co-activation during muscle contractions and MAP Tra /IO compared with nulliparous women (Table I).

Table I - Electromyographic Behavior of the muscles Tra/IO and MAP during maximal voluntary contraction in pregnant primigravid and nulliparous women

Exercises	P
Tra /IO response during maximal MAP	0,0007***
AP response during isometric exercise abdominal (Tra/IO)	0,00001***

**Teste de Contrastes Ortogonais.*

***Valor significativo, considerando $p \leq 0,001$

Interpretation of results:

Several authors have reported the importance of co-activation between muscles Tra /IO and MAP under conditions fisiológicas (1; 2; 3). However, so far not found other studies that may clarify what is the behavior of these muscles in different conditions, such as in pregnancy, where these muscles undergo physiological effects of pregnancy, whether biochemical (hormonal) or biomechanical (physical).

In assessing the muscles Tra/IO and pelvic floor of nulliparous women, through surface electromyography, our study found significant simultaneous motor response, arising from the co-activation of these muscles during their maximal voluntary contractions. However, despite the women's group to show homogeneous, were not observed to co-activation between these muscles in the group of pregnant women. These findings allow us to infer that pregnancy per se influences the physiology of muscle, preventing the abdominopelvic synergy.

Concluding message:

Co-activation between the muscles transversus abdominis / internal oblique pelvic in nulliparous women without complaints of pelvic floor dysfunction. Or pregnancy did not show co-activation between the muscles transversus abdominis / internal oblique and pelvic floor.

References

1. Sapsford RR, Hodges PW, Richardson CA, Cooper DH, Markwell SJ, & Jull GA. Co-activation of the abdominal and pelvic floor muscles during voluntary exercises. *NeuroUrol and Urodyn* 2001; 20: 31-42.
2. Neumann P, Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and Intra-abdominal pressure. *International Urogynecology Journal*. 2002; 13: 125-32.
3. Bø K. Pelvic floor muscle training is effective in treatment of female stress urinary incontinence, but how does it work? *Int Urogynecol Journal* 2004; 15: 76-84.

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Is this a clinical trial?	Yes
Is this study registered in a public clinical trials registry?	Yes
Specify Name of Public Registry, Registration Number	Study approved by the Ethics and Research - Pontificia Universidade Catolica de Minas Gerais Campus Poços de Caldas. (SEAC 0307.0.213.213-07).
Is this a Randomised Controlled Trial (RCT)?	No
What were the subjects in the study?	HUMAN
Was this study approved by an ethics committee?	Yes
Specify Name of Ethics Committee	Study approved by the Ethics and Research - Pontificia Universidade Catolica de Minas Gerais Campus Poços de Caldas.
Was the Declaration of Helsinki followed?	Yes
Was informed consent obtained from the patients?	Yes