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FACTORS THAT AFFECT THE CO-ACTIVATION AMONG THE PELVIC FLOOR MUSCLES AND TRANSVERSUS ABDOMINIS/ INTERNAL OBLIQUE

Hypothesis / aims of study

Recently, a theoretical model involving training of the deep abdominal muscles, in particular the transversus abdominis (Tra), to increase tonic pelvic floor muscle (PFM) activity has been suggested. However, some studies have pointed out that this behavior can be altered in specific groups or conditions, such as pregnancy or post partum [1], but there was no sufficient scientific evidence to recommend such therapy as a routine [2]. Its necessary to better understand the factors that influence the co-activation between Tra and PFM in order to better target and increase the effectiveness of the PFM training. Therefore the aim of this study was to assess the PFMs muscle response during maximum voluntary contraction of Tra/OI, and vice versa, and evaluate the relationship of co-activation of those muscles with the variables: age, body mass index (BMI), pregnancy, postpartum, physical activity, number of pregnancies, presence and severity of urinary incontinence assessed by ICIQ-UI SF and the presence of symptoms of overactive bladder (OAB) assessed by ICIQ -OAB.

Study design, materials and methods

This is a clinical, controlled, prospective study that consisted of 92 women who had body mass index ≤25 kg / m² and the average age of 28.52 years (SD ± 10.55). Most of the women were married, (50%), with white skin color (80%), completed high school (43.48%), and employed (52.15%). Regarding physical activity, 56.52% were sedentary, while 23.91% of the women performed low-impact physical activity (23.91%). During the evaluation, 57.61% reported no sexual activity and 64.13% declared stool frequency greater than three times a week. The women were recruited from March 2011 to June 2013 from a public health service center. All patients were evaluated with digital palpation prior to the inclusion. Only patients who were able to contract the PFM were included in the study. Exclusion criteria included women with pelvic organ prolapse, diabetes, hypertension, neurological abnormalities, myopathy, chronic lung diseases, presence of urinary tract infection, body mass index (BMI) equal or greater than 25kg/m^2, and/or previous abdominal muscles training.

Pelvic Floor and Transversus Abdominis/Internal Oblique Electromyography: The rest and PFM and Tra/IO contractility was registered using a surface electromyography equipment (EMG System do Brasil, 400C model). The volunteer was positioned in standing position and the abdominal region was cleaned with 70% alcohol. To test for the correct Tra/IO contraction, electrical activity generated with contraction was evaluated using surface sensors (disposable, 3M) placed on the muscles' area, two centimeters away from the anterior iliac crest, in the direction of the pubic area and by palpating the inward movement of the abdominal wall without moving the pelvis or the lower lumbar spine. Breathing was standardized by giving the following instructions: take a moderate breath in, let the breath out, and then contract the Tra. The contraction of the PFM has been previously taught to the volunteer, requesting her to press the probe in cranial direction and observing its contraction on the computer screen. Each requested contraction, was performed with a rest period of twice the time of the performed contraction, in order to avoid muscle fatigue. Pelvic floor EMG was recorded using a vaginal probe (Physio-Med Services), which has two opposing metal sensors. The probe was inserted and manually positioned, by the researcher, with the aid of KY's hypoallergenic gel, with the metallic sensors placed laterally in the vagina. The reference surface electrode was positioned on the right wrist. PFM and Tra/IO evaluation was performed by supinely positioning the subjects with, flexed lower limbs with the feet on the stretcher. Both sensors were connected to the EMG equipment, that transmitted the electrical signals in microvolt (mV) to a notebook, making sure that all electrical equipment were unplugged from the electrical power line, though working with their own batteries, in order to avoid any kind of interference [1].

EMG evaluation protocol: The protocol consisted of rest period recording and then**,** three, maximal, voluntary PFM contractions, recorded by the vaginal probe (channel 1). The contraction of the PFM has been previously taught to the volunteer, requesting her to press the probe in cranial direction and observing its contraction on the computer screen. Each requested contraction, was performed with a rest period of twice the time of the performed contraction, in order to avoid muscle fatigue. Later, three, maximal, voluntary Tra/IO contractions were requested (channel 2). The volunteer was then instructed to perform an isometric contraction of the lower abdomen, during expiration. PFM and Tra/IO electrical activities were simultaneously registered. Each contraction was recorded for 5 sec, in microvolt and analyzed by root-mean-square (RMS). The arithmetic mean of three RMS was considered per analysis [1].

Statistical Analysis: ANOVA Models for repeated measures with the response variables transformed into posts, were used to assess the percentage change compared to rest considering each situation (pelvic floor contraction and contraction of the abdomen) and each muscle (pelvic floor and abdomen). The level of significance was set at 5%. The EMG values were expressed as percentage of activation through the formula:

$$p_{co} = \frac{mean\ 3\ RMS - rest}{rest}\ \text{x}\ 100$$

The variables studied were age, body mass index (BMI), pregnancy, postpartum, physical activity, number of pregnancies, presence and severity of urinary incontinence assessed by ICIQ-UI SF and the presence of symptoms of overactive bladder (OAB) evaluated through the ICIQ-OAB.

Results

According to the data analyzed, the variables that influence the abdominopelvic co-activation were: pregnancy (p=0.01), physical activity (p=0.03) and presence/severity of urinary incontinence as measured by the total score of the ICIQ UI-SF (p=0.005). Other factors such as age (p=0.60), BMI (p=0.50), postpartum (p=0.17), number of pregnancies (p=0.10) and the symptoms of Overactive Bladder, investigated by means of the total score of the ICIQ-OAB (p=0.16) were not significant.

Interpretation of results

Theses results were in accordance with those of Pereira et al [1], whose demonstrated that pregnancy exerts influence on the co-activation between Tra/OI and PFM. Although there are studies about the biomechanical and anatomical connections between Tra/OI and PFM, and about reflex responses of pelvic floor due to trunk and arms movements, still now there are not sufficient evidence to support the role of such co-activation in patients under moderate physical activity routine. Regarding urinary incontinence, we agree with Sapsford et al [3] that showed that abdominal muscle activity is a standard response to PFM exercise in subjects with no symptoms of PFM dysfunction. On the contrary, in incontinent patients, this synergistic recruitment is processed in a different way or is absent.

Concluding message

Pregnancy, physical activity, and presence/severity of urinary incontinence assessed by ICIQ-SF are factors that exert influence on co-activation between the Tra/OI and PFM. These results support the importance of evaluating the abdominal-pelvic muscle activity and consider them before defining training exercises for the pelvic floor muscles.

References

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Disclosures

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