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IMPACT OF THE GESTATION AND MODE OF BIRTH IN THE SYNERGY AMONG TRANSVERSUS ABDOMINIS/INTERNAL OBLIQUE MUSCLES AND PELVIC FLOOR: ELECTROMYOGRAPHIC EVALUATION.

Hypothesis / aims of study

Pelvic floor muscle training (PFMT) and abdominal muscles exercises should be carefuly evaluated and coached in order to improve their overall quality and results. So, it is of great importance to understand the synergy of the abdominal-pelvic area in different conditions, such as during pregnancy and puerperium, since during in those phases significant alterations of the abdominal and pelvic floor muscles happen, requiring specific attention and strategies during its supervision, for a real efficacy.

The objective of this observational study is to evaluate the electromyographic patterns of the transversus abdominis, obliquous internus and pelvic floor muscles simultaneously, during a protocol of exercises applied to a cohort of women in pregnancy and puerperium, in order to verify which conditions can alter their synergic contraction.

Study design, materials and methods

This is a clinical, observational, prospective and controlled study which was approved by the Research and Ethics Committee of *Pontifícia Universidade Católica de Minas Gerais* (protocol: 0307.0.213.213-07).

The sample was composed of 81 women with a mean age of 23. 56 years old (SD=4,82) selected from the Public Health Assistance Program of *Poços de Caldas* (MG, Brazil). Patients were divided into 4 groups: Group (A): 20 nulliparous; Group (B): 25 primiparous with gestational age superior or equal to 24 weeks; Group(C): 19 in late puerperal phase (40-60 days) after vaginal delivery; Group (D): 17 in late puerperal phase (40- 60 days) after cesarean delivery.

Three different analysis were made, according to the type of exercises: (a) electromyographic evaluation of the pelvic floor muscles and transversus abdominis/internal oblique during pelvic floor muscle (PMF) contraction exercises; (b) electromyographic evaluation of the pelvic floor muscles during isometric contraction exercises of the transversus abdominis/internal oblique and; (c) electromyographic evaluation of the pelvic floor muscles during the abdominal isotonic contraction exercises.

The procedures for placing the electrodes were standardized as follows: the disposable surface electrodes (3M®-USA) were positioned onto the abdominal area 2 cm above the right iliac crest, with the volunteer in orthostatic position. Once the volunteer was positioned in dorsal decubitus with knees and hip in flexion, the endovaginal probe (Physio-Med Services®-Brazil) was inserted by the physiotherapist using hypoallergenic vaginal gel (KY, Johnson´s & Johnson´s®, Brasil). The metal surfaces of the electrodes were kept in contact with the lateral vaginal wall, as clos as possible of levator ani muscles. Both electrodes were connected to the electromyographer (EMG System do Brasil®-Brazil, model 400C).

Electromyographic evaluation was performed as follows: for pelvic floor muscles evaluation, each volunteer was asked to contract the vagina and to squeeze the probe in cranial direction; for isometric contraction of the abdominal muscles, the volunteer was asked to contract the lower part of the abdomen; for the isotonic contraction of the abdominal muscles, the volunteer was asked to remove her scapula out of the table. The patients did not receive any instructions regarding muscle synergy prior to the tests. All the procedures were made by the same researcher. Electrical activity of the abdominal and pelvic floor muscles was simultaneously recorded by surface electromyography. All the required contractions were voluntary, max and repeated for three times. For the analysis of the results, 5 seconds from each simultaneous contraction were selected from the software in micro-volts (μV) and then analyzed with Root-mean-square (RMS). The arithmetic mean from de RMS of three contractions was used as evaluation parameter. The data were then evaluated by Variance Analysis (ANOVA) with Orthogonal Contrast Test using the statistic program “R” from R Development Core Team (2008). The significance level was 1%.

Results

The summary of the electromyographic analysis of the synergy of transversus abdominis/internal oblique and pelvic floor muscles are presented in table 1.

Table 1. Electromyographic analysis of the synergy among transversus abdominis/internal oblique muscles and pelvic floor muscles
(ANOVA with orthogonal contrast test – p-values)

Groups	**Protocols**		
	Abdominal synergy simultaneous to maximal PFM contraction	Pelvic floor muscles synergy simultaneous to abdominal exercises:	
		Isometric	Isotonic
Nulliparous compared to pregnant, after vaginal delivery and after cesarean-section	0,0007	0,00001	0,00002
Pregnant compared to post vaginal delivery and post cesarean-section	0,4509	0,7949	0,8355

Post vaginal delivery compared to post cesarean-section	0,2786	0,9633	0,4662

During exercises of the pelvic floor muscles, there was a significant synergic response of the abdominal muscles in the nulliparous group (p=0,0007) when compared to the other groups. However, among the others, there was not any significant response for those muscles.

In a similar way, when performing the isometric abdominal exercise, the nulliparous group did show significant synergy for pelvic floor contraction (p=0,00001) when compared to the others.

During isotonic abdominal exercise, the response of the pelvic floor muscle was once again significant in the nulliparous group (p=0,00002) while was insignificant in the pregnant and puerperal women.

Interpretation of results

The results are in accordance to the study of Neumann and Gill (2002)[1], which observed the recruitment of transversus abdominis/internal oblique during all contractions of the pelvic floor. However these authors did not refer to the sinergic muscle response in pregnant and puerperal women.

Our findings corroborate as well to those of Neumann e Gill (2002)[1] e Bo (2004)[2] which affirmed that co-activation of the transversus abdominis normally occurs during the pelvic floor muscles contraction in women who weren't in specific phases such as gestation and puerperium.

Finally, the presented study confirmed the findings of Sapsford et al (2001)[3],Neumann and Gill (2002)[1] and Bo (2004)[2], who showed synergic activation of the pelvic floor muscles during isotonic contraction of the abdominal muscles. There are not other studies aimed at pregnancy and puerperal phases up to this date.

Concluding message

There is synergy among transversus abdominis/internal oblique and pelvic floor muscles in young, nulliparous and healthy women. However, pregnant women and those at late puerperal phase do not present co-activation of the transversus abdominis/internal oblique and pelvic floor muscles. Also, these results are independent of the delivery mode.

References

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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	**This study was approved by Ethics Committee of the Pontifícia Universidade Católica de Minas Gerais- Brasil**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**