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RELATIONSHIP BETWEEN ABDOMINAL AND PELVIC MUSCLES ELECTROMYOGRAPHIC ACTIVITY AT REST AND DURING MAXIMAL PELVIC FLOOR MUSCLE CONTRACTION CHANGING ANKLE INCLINATION IN STANDING POSITION IN WOMEN WITH AND WITHOUT STRESS URINARY INCONTINENCE

Hypothesis / aims of study

Urinary continence is maintained thanks not only to pelvic floor muscle integrity but also to the coordination between pelvic floor and abdominal muscles enabling women to guarantee the continence status in situation with high urethral pressure levels. The increase in the intra-abdominal pressure chancing position, coughing, sneezing, laughing, is usually opposed by pelvic floor muscle activation and co-activation of the abdominal muscles. In fact an abdominal muscle co-activation seems to contribute to the generation of a strong pelvic floor contraction; moreover the synergic activation of pelvic and abdominal muscles is important in order to generate a suitable closure urethral pressure. A good coordination between abdominal muscles and pelvic floor muscles probably might compensate a weakness of the pelvic floor muscle tone. Several studies reported that the synergic activation of pelvic and abdominal muscles increases the ability of women to better contract pelvic floor muscles. A standing posture including various ankle positions might effectively facilitate pelvic floor muscle (PFM) activity through enhanced pelvic tilt in women with stress urinary incontinence (SUI), and an ankles dorsiflexion at 15° could be the best position to increase PFM activity (PFMa) although it is very uncomfortable. No data are available on healthy female population and according to abdominal muscle (AM) activity. We carried out this study to assess this aspect in women with and without FSUI.

Study design, materials and methods

A total of 66 women were selected: 35 (group B) complained of FSUI, and 31 (group A) were healthy volunteers. Exclusion criteria were: musculoskeletal problems; previous major abdominal or pelvic surgery; severe diseases; diabetes mellitus, a body mass index (BMI) >30 kg/m2; intraureterine device implantation; pelvic organ prolapse, menopause. An electromyographic (EMG) biofeedback instrument using surface electrodes was employed to measure changes in PFMa and abdominal muscle activity (AMa). During EMG recordings, each subject was asked to perform PFM 5s-contractions while assuming the following different positions: horizontal standing (HS), ankles dorsiflexion standing (DS) at 5° (5DS), 10° (10DS) and 15° (15DS), and ankles plantar flexion standing (PS) at 5° (5PS), 10° (10PS) and 15° (15PS). An adjustable basculant platform was used to passively set the ankle in each position. The following electromyographic parameters have been evaluated: rPFMa (resting PFMa), rAMa (resting AMa) (expressed in μV); maximal contractions taking into account both the maximum peak (mPFMa and mAMa, expressed in μV), and the area under the contraction curve (amPFMa and amAMa, expressed in μV*sec). PFMa and AMa have been recorded simultaneously. For statistical analysis a standard normal cumulative distribution has been used. Electromyographic activity has been reported in terms of mean values and standard deviations (SD) (($p<0.05$).

Results

Incontinent women were older than continent (P<0.001). Table I shows study population's clinical and demographic characteristics.

Table I. Study population clinical and demographic characteristics

Characteristics	Group A (n°31)	Group B (n°35)
Age (years): mean (range)	26 (18-35)	40 (28-49)
Parity: mean (range)	0 (0-0)	2 (0-3)
Voiding symptoms: number of subjects (%)	0 (0.0%)	0 (0.0%)
Nocturia: number of subjects (%)	0 (0%)	4 (11.4%)
BMI (kg/m2): mean (range)	22 (19-27)	24 (19-30)
Symptoms duration (years): mean (range)	0 (0-0)	10 (3-19)

Table II shows mean values and SD of rPFMa, mPFMa and amPFMa in the 7 analysed positions, according to the different groups.

Table II. Mean values and SD of rPFMa, mPFMa and amPFMa.* Significant differences between group A and group B.

Position	rPFMa (DS) μV	mPFMa (DS) μV	amPFMa (DS) μV*s
Group A			
HS	**19 (10)***	**344 (209)***	**682 (318)***
5PS	20 (10)	**391 (200)***	**712 (332)***
10PS	21 (13)	**374 (187)***	**706 (313)***
15PS	22 (12)	**359 (192)***	**698 (343)***
5DS	25 (13)	**359 (160)***	**680 (278)***
10DS	25 (10)	**339 (170)***	**654 (283)***
15DS	28 (10)	**338 (189)***	**653 (34)***
Group B			
HS	**26 (16)***	**227 (117)***	**447 (224)***
5PS	23 (12)	**265 (173)***	**489(323)***
10PS	23 (11)	**265 (180)***	**511 (335)***
15PS	24 (12)	**268 (170)***	**534 (331)***
5DS	27 (9)	**215 (113)***	**392 (183)***

10DS	29 (11)	**241 (146)***	**468 (256)***
15DS	31 (12)	**232 (130)***	**454 (221)***

rPFMa in HS was significantly higher in group B than in group A (26±16μV versus 19±10μV); mPFMa and amPFMa in all positions were always significantly higher in the continent group. Concerning the rPFMa, in both groups no significant difference was found between HS and PS, regardless ankle inclination. In incontinent women, rPFMa in DS, regardless ankle position, was significantly higher than in HS and PS. Similar results were observed in group A. Concerning mPFMa, no significant difference was found in group A changing ankle inclination. In contrast, in group B mPFMa was always higher in PS than in DS, regardless ankle position. The rAFMa reached the highest mean values in 15DS e 5PS in group A (31±20μV and 31±16μV, respectively) and in 15DS and HS in group B (30±13μV and 30±17μV, respectively). The mPFMa reached the greatest mean values in 10PS (135±50μV) in group A and in 5DS and 10DS (136±86μV and 136±93μV, respectively) in group B. The mPFMa reached the highest mean values in 5DS (72±73μV/s) in group A and in 10DS (67±42μV/s) in group B. The greatest mean value of amPFMa was recorded in 15PS (273±125μVs) in group A and 5DS (290±214μVs) in group B. Any significant difference was observed between the two groups in terms of AMa recording.

<u>Interpretation of results</u>

Concerning the resting PFMa no EMG differences were found in both groups between HS and PS, and between 10DS and 15DS. In incontinent women resting PFMa in DS at whatever angle was significantly greater than in both HS (P<0.020) and plantar flexion (P<0.040). Similar results were found in the healthy group, except for 5DS. Concerning the maximal PFMa, no EMG differences were found in continent women changing ankles inclination. In contrast, in SUI women maximal PFMa was significantly higher in 5PS than in both 5DS (P=0.006) and 15DS (P=0.010); and in 10DS than in 15DS (P=0.010).No EMG differences were found between 5PS and 10DS. Median maximal PFMa was always higher in continent women in all the positions, although a statistical significance was reached only in 5DS ans 15DS. Similar results were found concerning the AMa. The only difference is that at 15DS there is a dramatic increase in AM tone compared with the normal trend.

<u>Concluding message</u>

Although 15DS seems to be the best position to increase both PFM and AM tone, it might cause a dramatic increase in intra-abdominal pressure, probably interfering with the coordination between pelvic floor and abdominal muscles.

Specify source of funding or grant	**None**
Is this a clinical trial?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**No**
This study did not require eithics committee approval because	**subjects have been enrolled within the standard set for pelvic floor muscle rehabilitation**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**