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THE EFFECT OF ANKLE POSITION IN STANDING ON PELVIC FLOOR MUSCLE ACTIVITY IN HEALTHY YOUNG CONTINENT WOMEN – A PILOT STUDY USING TRANSVAGINAL ELECTROMYOGRAPHY AND ULTRASOUND IMAGING.

Hypothesis / aims of study

The purpose of this study was to examine the effect of ankle position on pelvic floor muscle (PFM) activity in healthy young continent women.

Study design, materials and methods

Ten healthy college aged continent women who could perform an appropriate volitional pelvic floor muscle (PFM) contraction were recruited for this observational pilot study. Each subject completed a bladder filling protocol to allow for delineation of the bladder from the pelvic floor fascia and associated PFM. An appropriate pelvic floor contraction was defined as cranial displacement of the bladder by the PFM when assessed in the transverse plane with ultrasound imaging (US). Subjects completed 5 PFM contractions of 5 seconds on and 5 seconds off at 3 different ankle positions (neutral, 15 degrees of plantarflexion, and 15 degrees of dorsiflexion) randomly ordered using a slant board. Two minutes rest was provided between each testing position. Resting and mean maximal PFM activity were recorded. On screen callipers were used to measure bladder displacement in millimetres during pelvic floor contractions. All subjects were blinded to US imaging and EMG.

Results

The Wilcoxon signed ranks test was conducted on pairwise comparisons of the three testing positions. Level of significance set at p =.05. The statistical power was post hoc calculated to be 0.32. Resting tone of the PFM was greatest in dorsiflexion (27.49±8.8) compared to neutral standing (24.88±8.7) and plantarflexion (24.7±7.9; p=0.17). Subjects produced greatest mean maximal PFM activity in dorsiflexion (60.89±28.2) compared to neutral and plantarflexion stance. The greatest amount of US displacement was seen in plantarflexion (10.13 mm) when compared to neutral standing (7.71 mm) and dorsiflexion (7.08 mm). Significant differences were noted during neutral stance compared to plantarflexion stance (p=.047) and dorsiflexion stance compared to plantarflexion stance (p=.022).

Table 1.
PFM activity of resting EMG, mean maximal EMG and US displacement during PFM contractions in various standing postures

Position and mean Pelvic incl Angle (°)	*Resting Tone (µV)*	*Mean Maximal Contraction (µV)*	*P Value*	*Mean Ultrasound Displacement (mm)*
NS (4.2)	24.88 ± 8.70	59.78 ± 30.67	.008	7.71 ± 2.23
DF (5.9)	27.49 ± 8.81	60.89 ± 28.16	.005	7.08 ± 3.39
PF (4.49)	24.68 ± 7.96	59.7 ± 33.20	.005	10.13 ± 4.07

† *P value represents analysis with resting tone EMG*
† † *P value represents analysis with mean maximal PFM contraction*

Key: NS = Neutral standing; DF = 15ºdorsiflextion; PF=15º plantarflexion

TABLE II. P Values of difference in PFM activity assessed with EMG and US displacement across three postures.

Position	*Resting Contraction*	*Mean Maximal Contraction*	*Mean Ultrasound Displacement*
DF – NS	0.074	0.96	0.38
NS-PF	0.57	0.24	0.047
DF-PF	0.017	0.3	0.022

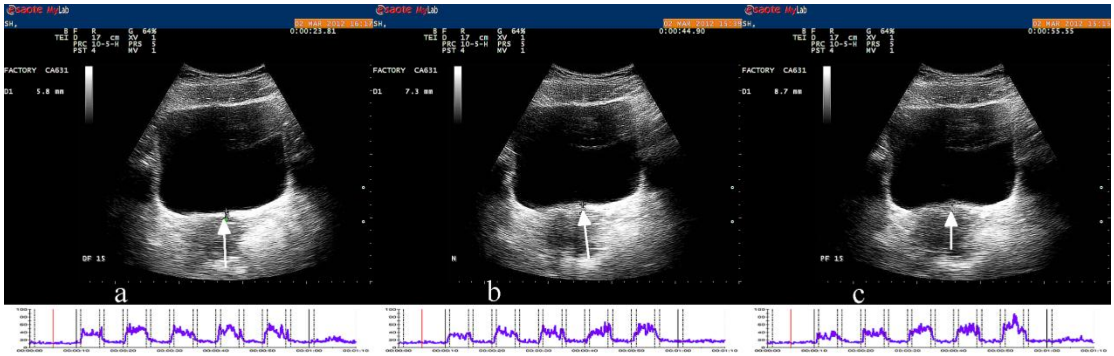

Figure 1.
Ultrasound images and EMG output: a) 15° dorsiflexion, b) neutral standing and c) 15° plantarflexion showing cranial displacement (white arrow) and changes in EMG amplitude during PFM contraction.

Interpretation of results

Previous studies have assessed the effect of different postures (sitting, standing) on PFM activity, but limited knowledge exists on the effect of imposed pelvic inclination angle on PFM activity in standing as measured by US imaging and EMG. Stance on a slant board imposes a change in the pelvic inclination angle leading to an effect on PFM EMG activity (1). While limitations exist for EMG measurement, US displacement due to PFM activity has been shown to represent the ability of an individual to recruit elective motor units, and reach close to maximum contraction inferring that greater cranial displacement represents maximal PFM contraction (2). PFM hypertonicity is implicated in many pelvic floor disorders including incontinence and affects muscle contractility (3). This pilot study showed that those with the lowest resting EMG tone produced the greatest cranial displacement on US imaging and greatest US displacement was noted in the plantarflexion standing position. This finding suggests that the PFM could maximise the benefits of its length tension relationship in producing a PFM contraction. However, since our study is underpowered a larger study is required to determine if our findings can be generalized.

Concluding message

Few studies have explored the ideal ankle position for optimal PFM contraction. Our findings found that plantarflexion stance facilitates greater cranial displacement on US imaging which has been shown to be a valid measure of PFM function (2). Further study is required on the normal population and those with pelvic floor dysfunction before the findings of this study can be generalized.

References

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Disclosures

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