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Poster 534
The Impact of a Familiarization Session on Pelvic Floor Muscle Dynamometry Outcomes In Women

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Introduction

A single training session can increase force outcomes in some muscle groups, while results from other muscle groups are less clear [1]. The current standard in pelvic floor dynamometry is that a research assistant will confirm proper pelvic floor muscle (PFM) contraction through digital palpation, and will provide verbal and tactile cueing to ensure the participant can perform an adequate contraction prior to data collection.

No study has investigated the impact of task familiarization on forces measured from the PFMs using intra-vaginal dynamometry. **This effect may be important since more than 20% of women are unable to contract their PFMs correctly upon initial evaluation** [2] and thus motor learning is highly relevant to the measurement of PFM function. The results of this study will provide a basis for protocol development using intra-vaginal dynamometry to assess PFM function in women.

Objective

To investigate the impact of task familiarization on active and passive PFM properties measured in nulliparous women using a custom automated intra-vaginal dynamometer.

Methods

The protocol was first approved by our institutional research ethics board and was consistent with the Declaration of Helsinki.

20 nulliparous women were recruited and provided written informed consent.

The protocol involved three visits: 1 familiarization session (V1) and 2 assessment sessions (V2 and V3) at one-week intervals.

Prior to each assessment the physiotherapist provided instructions to ensure that women were performing a proper PFM contraction as per the standard in the field.

Forces were recorded in supine with a dynamometer [3] inserted into the vagina while women performed three repetitions of:

- A maximal voluntary contraction with a total anteroposterior diameter set to **25mm** then **35 mm**.
- Resistance to passive stretch while the anteroposterior diameter of the dynamometer moved from 15mm to 40mm at a rate of opening of **25mm/s** then **50mm/s**. This position was held for 5s and then the arms returned to their initial position.

Statistical analyses:

- Between-session effects were tested using one-way repeated measure ANOVAs (α=0.05).
- Between-trial effects were tested using one-way repeated measure ANOVAs (α=0.05).

Equipment

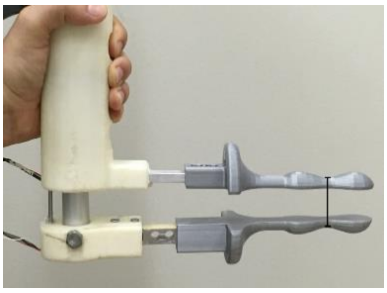

Figure 1. Automated, servo-controlled intravaginal dynamometer. The arrow indicates the antero-posterior diameter measured as the total diameter including the aperture and the thickness of the 3D-printed arms at the location of the pelvic floor muscles when inserted. Force data were sampled at 100Hz and filtered using a 2nd order dual-pass low-pass Butterworth filter with a cutoff of 5Hz.

Outcomes of interest

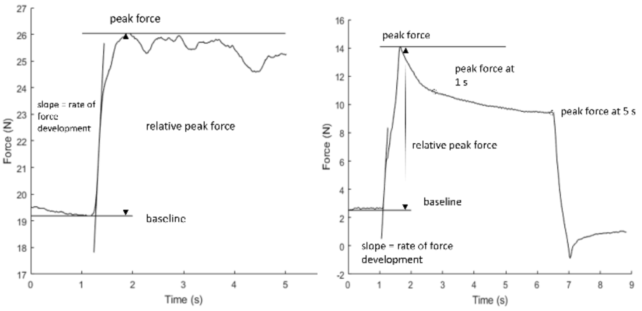

Figure 2. *(A) Sample raw active force data recorded during a maximal voluntary pelvic floor muscle contraction performed with the dynamometer anteroposterior diameter set at 35mm. Note the baseline force takes time to settle after the arms of the dynamometer have opened to the set diameter and should be stable before the participant is instructed to contract.*
(B) Sample raw passive resistance force data recorded during dynamometer opening from a minimum of 15mm to a maximum anteroposterior diameter of 40mm at a rate of 50mm/s.

Results

Twenty nulliparous women previously naïve to pelvic floor muscle exercise participated, with a mean (±SD) age of 35 (±15) years and mean (±SD) body mass index of 23.47 (±4.04 kg/m^2).

No significant differences were found across the three visits for any force outcomes studied during a PFM contraction (Table 1) and during resistance to passive stretch (Table 2) (p>0.05).

Table 1. Active force outcomes by visit. *Mean peak values +/- standard error (SE) are presented for data acquired during the maximal effort PFM contraction (MVC) with the dynamometer diameter at 25mm and 35mm.*

		Sample Size (n)	Visit 1 Mean (+/- SE)	Visit 2 Mean (+/- SE)	Visit 3 Mean (+/- SE)
MVC at 25 mm	Baseline (N)	17	8.01 ± 0.56	7.24 ± 0.36	7.46 ± 0.50
	Peak force (N)	18	12.68 ± 0.60	12.08 ± 0.42	12.69 ± 0.49
	Rate of force development (N/s)	18	22.67 ± 2.67	22.89 ± 2.34	23.21 ± 3.08
	Relative peak force (N)	18	5.02 ± 0.35	5.10 ± 0.34	5.23 ± 0.47
MVC at 35 mm	Baseline (N)	16	12.28 ± 0.91	11.36 ± 0.54	11.59 ± 0.75
	Peak force (N)	17	20.66 ± 0.98	19.72 ± 0.72	20.18 ± 0.74
	Rate of force development (N/s)	17	34.79 ± 5.55	36.00 ± 4.63	9.02 ± 0.76
	Relative peak force (N)	17	9.02 ± 0.76	8.70 ± 0.61	8.91 ± 0.78

Table 2. Passive resistance outcomes by visit. *Mean peak values +/- standard error (SE) recorded during the passive elongation of the PFMs while the dynamometer arms opened from 15mm to 40mm at two rates: 25mm/s and 50mm/s.*

		Sample Size (n)	Visit 1 Mean (+/- SE)	Visit 2 Mean (+/- SE)	Visit 3 Mean (+/- SE)
Resistance at 40 mm – Slow (25 mm/s)	Baseline (N)	20	3.05 ± 0.29	3.34 ± 0.45	3.04 ± 0.29
	Peak force (N)	20	15.27 ± 0.98	14.78 ± 0.98	15.39 ± 1.03
	Rate of force development (N/s)	20	24.97 ± 1.13	24.23 ± 0.72	24.53 ± 0.70
	Relative peak force (N)	20	12.15 ± 0.84	11.38 ± 0.76	12.15 ± 0.83
Resistance at 40 mm – Fast (50 mm/s)	Baseline (N)	19	2.77 ± 0.23	3.73 ± 0.49	3.22 ± 0.28
	Peak force (N)	19	16.84 ± 0.96	17.55 ± 1.22	17.39 ± 1.02
	Rate of force development (N/s)	19	44.78 ± 1.39	44.43 ± 1.62	45.48 ± 1.44
	Relative peak force (N)	19	14.03 ± 0.86	13.76 ± 0.90	13.99 ± 0.84

Conclusions

We found no evidence of motor learning on active or passive forces measured from nulliparous women naive to pelvic floor muscle exercise when dynamometric measures were made over three sessions spanning a two week period.

Ensuring that women perform a correct pelvic floor muscle contraction prior to data collection involving intra-vaginal dynamometry appears to be adequate to study PFM mechanics in this population.

Future directions: the impact of motor learning on dynamometry outcomes from women who report symptoms associated with PFM dysfunction, such as urinary incontinence, pelvic pain and pelvic organ prolapse, may yield different results and should be evaluated.

[1]:Ploutz-Snyder et al. (2001). The Journal of Strength & Conditioning Research, 15(4); p. 519-523.
[2]:Kandadai P, O'Dell K, Saini J. (2015). Female Pelvic Med Reconstr Surg, 21(3); p. 135–140.
[3]:Bérubé et al. (2018). Neurourology and Urodynamics, 37(6); p. 1875-1888.