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COMPARING PELVIC FLOOR MUSCLE TONE IN POSTMENOPAUSAL CONTINENT AND STRESS URINARY INCONTINENT WOMEN

Hypothesis/aims of study

Physiotherapy treatments aim at increasing the pelvic floor muscle (PFM) strength. However, some clinical trials have shown marked improvement, even cure, of stress urinary incontinence (SUI) without demonstrating any significant improvement in maximal strength, possibly indicating that other parameters play an important role in continence. So far, indirect evidence suggests that the passive properties of PFM, or tone, might be involved in treatment mechanisms. To better understand the role of the PFM in continence, a few studies have compared PFM resting forces in continent and SUI women [1-3]. The controversial results may be explained by methodological issues, such as taking the measurements at fixed and static vaginal apertures. Since the visco-elastic properties of tissues are time-dependent, a factor not accounted for in earlier measurements, a new methodology has been developed to assess the PFM passive properties dynamically while controlling for unwanted PFM contractions. The purpose of this study was to compare the PFM passive properties in postmenopausal continent and SUI women.

Study design, materials and methods

Thirty-four continent and 34 SUI postmenopausal women were evaluated in a supine lying position by an experienced physiotherapist. The PFM passive properties were assessed using a modified intra-vaginal dynamometric speculum in four conditions (the mean of two repetitions was considered in the analysis): 1- initial passive resistance (forces at 15-mm vaginal aperture); 2- passive resistance at maximal aperture (determined by the patient tolerance or increase in EMG activity (>twice the resting values)); 3- passive resistance at 25-mm vaginal aperture; 4- five lengthening and shortening cycles (with the PFM and surrounding tissues stretched at constant speed by increasing the vaginal antero-posterior diameter). Among other parameters, the forces and passive elastic stiffness (PES) (slope of the curve) were evaluated at different apertures in this condition and the hysteresis was also calculated (area between the lengthening and shortening curve). Maximal voluntary strength and the contribution of the passive forces to the total voluntary strength were also calculated. Independent t-tests were used to compare the PFM passive function between the two groups.

Results

The two groups were similar for all baseline characteristics (age, parity, body mass index, hormonal replacement therapy, physical and sexual activity) ($p>0.05$).

Table 1: PFM passive properties in continent and SUI women

Conditions	Parameters	Mean ± 1 SD		P values
		Continent	SUI	
1) Initial resistance	Passive forces (N)	0.62 ± 0.58	0.34 ± 0.53	0.044
2) Resistance at max. aperture	Passive forces (N)	2.85 ± 1.24	2.24 ± 1.24	0.049
3) Resistance at 25-mm aperture	Passive forces (N)	1.73 ± 1.13	1.53 ± 1.20	0.494
4)Lengthening and shortening cycles	Force at minimal aperture (N)	-0.02 ± 0.45	-0.23 ± 0.43	0.045
	Force at maximal aperture (N)	3.50 ± 1.37	2.59 ± 1.46	0.013
	Force at mean aperture (N)	1.71 ± 0.76	1.27 ± 0.83	0.029
	Force at aperture of 20mm (N)	1.30 ± 0.80	1.04 ± 0.76	0.201
	PES at minimal aperture (N/mm)	0.11 ± 0.11	0.12 ± 0.08	0.664
	PES at maximal aperture (N/mm)	0.44 ± 0.23	0.33 ± 0.17	0.038
	PES at mean aperture (N/mm)	0.30 ± 0.17	0.29 ± 0.16	0.885
	PES at aperture of 20mm (N/mm)	0.19 ± 0.14	0.19 ± 0.17	0.930
	Hysteresis (N*mm)	9.62 ± 5.30	7.08 ± 5.00	0.053

As shown in Table 1, in the lengthening and shortening cycles, SUI women had lower passive forces at minimal, mean and maximal apertures ($p<0.05$) as well as lower PES at maximal aperture. However, a trend toward higher vaginal apertures in continent women was also observed ($p=0.100$), which may bias the forces recorded at these apertures (as illustrated in Figure 1). This is supported by the non-significant difference between the two groups for the forces at the common apertures of 20 and 25 mm. Lower passive resistance at 15-mm vaginal aperture was found in incontinent women.

Figure 1: Forces at minimal, mean and maximal apertures in continent and SUI women

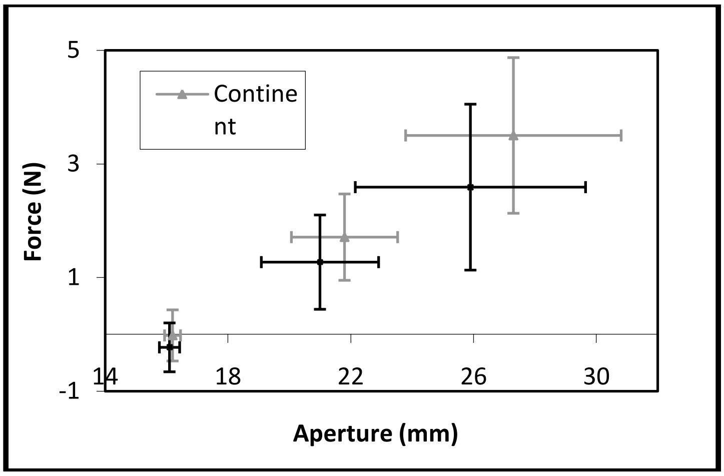
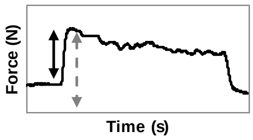


Table II: Maximal voluntary strength and contribution of the passive forces

Parameters		Mean ± 1 SD		P values
		Continent	SUI	
PFM maximal voluntary strength (N) (total strength – passive forces)		4.46 ± 2.92	1.83±1.74	<0.001
PFM total strength (N)		6.10 ± 3.35	3.74 ±3.05	0.005
Contribution of passive forces to total strength (%) ((passive forces/total strength)*100)		33 ± 22	46 ± 22	0.028

SUI women demonstrated lower maximal voluntary strength (p=0.005) and a higher contribution of passive force to total voluntary strength (p=0.028).

Interpretation of results

Hypothesizing a continence model in which an absolute force level is required to properly occlude the urethra, loss in passive forces could seriously jeopardize continence. The importance of PFM passive forces to continence is well supported by the fact that nearly half the PFM total strength is due to passive forces.

The lower initial passive resistance and higher contribution of passive forces to total voluntary strength in incontinent women support the role of passive properties in continence maintenance. The difference in passive properties between continent and SUI women could not be confirmed at larger vaginal apertures, however, because of the potential bias of the former's slightly higher vaginal aperture.

Concluding message

This methodology provides new information on PFM tone since it is the first study to assess the PFM passive properties both statically and dynamically while the involuntary PFM activity is monitored by EMG measurement. The importance of the contribution of the passive forces to the total strength is also underlined.

References

1. Physiol Meas 2007: 28(11):1429-1450.
2. Neurourol Urodyn 2007: 26(6):852-857.
3. Neurourol Urodyn 2004: 23(7):668-674.

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Is this a clinical trial?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**Ethics Committee of the Centre hospitalier de l'Université de Montréal**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**