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Dumoulin C[1], Boudreault N[1], Morin M[2], Corriveau H[2], Tang A[1], Corcos J[3], Tannenbaum C[1], Lemieux M[1]
***1.** University of Montreal, **2.** University of Sherbrooke, **3.** McGill University*

CHARACTERIZING AND COMPARING PELVIC FLOOR MUSCLE FUNCTION IN CONTINENT AND URINARY INCONTINENT OLDER WOMEN USING DYNAMOMETRY

Hypothesis / aims of study: A large proportion of women aged 60 and over experience mixed urinary incontinence (MUI) and its negative consequences on their quality of life; however, to date, the pathophysiology of this disorder is not completely understood. The aims of this study were to characterize and compare, using dynamometry, the function of the PFMs in continent and MUI women aged 60 and over. We hypothesized that continent older women would present higher PFM dynamometric values than those with MUI for the following parameters: for *passive forces (tone)* at rest; for *maximum strength* during a 10-s PFM voluntary contraction task; for the mean *rate of force development* and for the *number of rapid contractions* during a rapid, repetitive PFM contraction task; and, finally, for mean *rate of force development* and *PFM maximal strength* during a triple cough task.

Study design, materials and methods: This report is based on a cohort study nested within a larger prospective quasi-experimental cohort study on continent and MUI older women. Continent and MUI older women, aged 60 and over, participated in the study. They were recruited from five continence clinics and through newspaper ads or posters. Continence was defined as the absence of any involuntary leakage of urine in the past 12 months as verified by the Urogenital Distress Inventory (UDI) questionnaire. Urinary incontinence was defined as *a weekly average of one or more episodes of involuntary urine loss during the preceding 3 months.* The type of UI (mixed) was established by the self-diagnostic item on the UDI questionnaire with the *number of leakages on effort, exertion, sneezing or coughing* exceeding the number related to urgency. To be included in the study, women had to be living in the community, be independently ambulatory and to have had at least one vaginal delivery. Women on hormone replacement therapy were included as long as their prescription had been stable for the preceding 6 months or longer. Women were excluded if they had other types of UI, presented risk factors of UI known to interfere with normal PFM function, experienced perineal pain or a marked genital prolapse likely to interfere with the PFM evaluation, had any acute or chronic medical conditions, or took medications that could have interfered with the study. After signing a consent form, women underwent a 1h standard assessment including a 30-min in-person interview and a 30-min dynamometric examination of their PFMs with a trained evaluator. The 30-min dynamometric examination followed a standardized procedure that was developed in earlier studies and was also proven to be feasible with older women.[(1)] Women were asked to empty their bladders, to undress from the waist down and to adopt a supine position on a conventional examining table with hips and knees flexed and supported, feet flat on the table. A trained physiotherapist gave detailed instructions on how to contract the PFMs; she then verified, using vaginal palpation, the woman's understanding of how to perform a proper PFM contraction. The participant was asked to squeeze and lift the PFMs as if preventing the escape of flatus and urine while breathing out. Subsequently, the two branches of the dynamometric measuring device were closed and inserted into the vaginal cavity in an antero-posterior axis to a depth of 5cm. The evaluator then separated the two branches to obtain a 25-mm vaginal aperture (antero-posterior diameter). Four measurement tasks were completed: a 10-s rest task, a 10-s PFM voluntary contraction task, a rapid repetitive PFM contraction task (women were asked to do as many maximal rapid contractions and relaxations as possible in 15-s) and, finally, a triple cough task. As suggested by Caldwell for dynamometric testing of the limb muscles, all trials were separated by a 2-min rest period to avoid fatigue. All dynamometric values were presented as mean values with standard deviations for the two subgroups; continent and MUI. Dynamometric parameters of the MUI group were then compared to those of the continent group using independent-sample t-tests.

Results

Eighty-nine women participated in this study; 23 continent and 66 with MUI. There were no differences among the groups in either age ($p = 0.254$), body mass index ($p = 0.113$) and parity ($p = 0.406$). The pelvic floor dynamometric characteristics of the continent and MUI women are presented in Table 1. There were no significant differences in the measurements *for mean rate of force development during a rapid,* repetitive PFM contraction task, or for the mean *rate of force development* and *PFM maximal strength* during a triple cough task. However, there were significant differences in the measurements for *passive forces at rest*; *maximum strength* during a 10-s PFM voluntary contraction task; and the *number of rapid contractions* during a rapid, repetitive PFM contraction task. The magnitude of the differences between the means for *passive forces at rest* and the *number of rapid contractions* during a rapid, repetitive PFM contraction task were small to moderate (eta squared = 0.04 and 0.06 respectively). The magnitude of the differences between the means for *maximum strength* during a 10-s PFM voluntary contraction task was moderate to large (eta squared = 0.08).

Table 1 Pelvic floor dynamometric characteristics in continent and MUI women

	Continent (N =23)	***MUI (N =66)***	P-values (one-tailed)
Passive forces at rest (tone) (N)	1.49 (1.44)	0.98 (0.71)	0.045*
Maximal strength during voluntary contraction task (N)	4.77 (3.83)	2.38 (2.16)	0.021*
Mean rate of force development during a rapid, repetitive PFM contraction task (N/s)	7.29 (6.79)	7.07 (6.74)	0.451

Number of rapid contractions during a rapid, repetitive PFM contraction task	7 (3)	6 (2)	0.008*
Mean rate of force development during a cough task (N/s)	13.06 (13.47)	10.34 (10.22)	0.181
Maximal strength during a cough task (N)	5.09 (5.29)	4.44 (4.31)	0.300

All measurements are expressed as mean (SD). Significant difference: $p<0.05$ *

Interpretation of results

Women with MUI showed lower passive force at rest, demonstrated lower maximal strength during the voluntary contraction task and produced fewer rapid contractions during the rapid, repetitive PFM contraction task. These results mirror some of the dynamometric results found in a previous study that looked at PFM function in continent and stress urinary incontinent younger women; they found that parameters such as passive forces and the number of rapid contraction also differentiated continent from urinary incontinent younger women.[(2)]However, although the dynamometric measurements in both studies were taken at a similar vaginal opening, the results differ slightly in that ours were lower and had larger confidence intervals. Further, they also differ in that, in contrast to the previous study on younger women, we found that PFM strength differentiated between continent and MUI older women. It can be hypothesised that since urethral closure pressure is generally lower in older women, greater PFM strength may compensate for this decline, differentiating continent and incontinent women. This would explain the differences we found between continent and MUI women, but a direct comparison of younger and older women would be needed to verify this hypothesis. Finally, the study's findings support the biological rationale for the passive, active and coordination roles performed by the PFMs in the maintenance of continence.[(3)] Studies with a larger cohort are needed to further increase our understanding of MUI pathophysiology in older women.

Concluding message: Pelvic floor muscle function is impaired in older MUI women. Parameter such as passive force, strength and coordination appears to be involved. These findings support the rationale for PFM training in older MUI women.

References

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Was this study approved by an ethics committee?	**Yes**
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Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**