

THE EFFECT ON THE PELVIC FLOOR MUSCLES (PFM) AND URETHRA DURING A COUGH IN CONTINENT AND STRESS URINARY INCONTINENT (SUI) WOMEN.

Aims of study

To describe the function of the PFM and the displacement, velocity and acceleration of the urethra during a cough in continent and SUI women.

Study design, materials and methods

31 volunteers performed a cough with an ultrasonic transducer placed on the perineum in a mid sagittal orientation. Video recordings of imaging signals were recorded on a PC for off-line analysis. Methods for the reliable novel image analysis have been reported^(1,2). One-tailed unpaired T-tests were used to compare the mean values (+SD) for significant differences in displacement, velocity and acceleration of the ano-rectal angle (ARA) and urethra.

Results

	Age	Parity	Body Mass Index	Continence Severity Scale ⁽³⁾
Continent (N=22)	41.1± 13.6	0.4±0.9	22.4 ±1.99	Continent
SUI (N=9)	47.9 ± 13.2	1.6±0.7	24.98±4.11	5 slightly incontinent 4 moderately incontinent

The PFM of continent women provided a force towards the urethra and pubic symphysis, prior to any downward displacement of the pelvic floor (PF), indicated by the initial direction of displacement, velocity ($p < 0.05$) and acceleration ($p < 0.05$) of the ARA. The PF and the urethra of the SUI group however were both elongated dorsal-caudally. The urethra of this group was displaced twice the distance ($p < 0.001$), with almost twice the maximum velocity ($p < 0.01$). The maximum accelerations were not significantly different, but were applied for longer in the SUI group. The continent urethra described a co-linear path; however transverse velocities and accelerations existed in SUI urethral trajectory.

	Displacement (cm)	Angle (degrees)
ARA		
Continent	0.77±0.36	285°±42
SUI	1.07±0.40	260°±18
P Value	<0.01	<0.05
Urethra		
Continent	0.84±0.30	239±16.9
SUI	2.08±0.65	235±8
P Value	<0.001	NS

Interpretation of results

The urethra of SUI women moves further and faster in response to a cough, due to the restraining forces not increasing as rapidly with displacement as those in continent women; evidence that the urethra and PF of SUI is more compliant than that of continent women. Normal PFM function is like a brake, producing compression of the PF and additional external support to the urethra. In contrast the SUI PF is similar to a 'saggy passive trampoline'; once the tissues have been exposed to this downward stretch they rebound with greater velocity.

Concluding message

This study characterises the automatic dynamic function of the PFM and accurately describes the trajectory of the urethra during a cough. Significant differences exist in the behaviour of the PFM and urethra of women with SUI compared with continent controls.

References

1. Annals of Biomedical Engineering (2006) **34**; 477-493.
2. Ultrasound in Medicine & Biology (2007) **33**; 342-352.
3. Neurourol Urodyn (2000) **19** 137-45

Specify source of funding or grant	This work was funded in part by NIH, grant 1R21 EB001654-1
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	Institutional Review Board of Stanford University
Was the Declaration of Helsinki followed?	Yes
Was informed consent obtained from the patients?	Yes