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THE PUBORECTALIS MUSCLE ANATOMY AND FUNCTION IN WOMEN WITH FECAL INCONTINENCE VERSUS PAROUS CONTROLS: A CASE-CONTROL STUDY.

Hypothesis / aims of study
The puborectalis muscle (PRM) is the portion of levator ani that originates on the pubic bone and slings around the anal canal forming the anorectal angle and thought to participate in maintaining fecal continence. The pressures measured in the vagina are thought to be generated from the levator ani muscles. Our hypothesis was that the subjects with fecal incontinence (FI) will demonstrate more anatomic abnormalities and compromised function of the PRM compared with continent controls. The aim of this study was to investigate the PRM anatomy by three-dimensional ultrasound (3DUS) and the PRM function determined by vaginal manometry in a case control study of patients with fecal incontinence (FI) and vaginally parous controls.

Study design, materials and methods
25 patients with FI (FISI>20) [1] and 20 vaginally parous controls without symptoms of fecal or urinary incontinence were evaluated. Transperineal 3DUS was performed to visualize the PRM and pelvic floor hiatus at rest and during a sustained pelvic floor contraction (squeeze). Voluson 730 (General Electric Healthcare, Milwaukee, WI) and HD11 (Philips Medical Systems, Bothel, WA) with 5-9 MHz (Voluson) and 3-9 MHz (HD-11) endo-vaginal transducers were used in the study. The proprietary software Q-lab 5.0 (Philips) and 4D-View (General Electric) was used to analyse the 3DUS volumes. The PRM and the pelvic floor hiatus were localized on the images and the anterior posterior length (APL) of the pelvic floor hiatus was measured from the pubic bone to the midline of the PRM inner edge. The scoring system for the PRM was created by modifying a levator ani MR scoring system [2]. The two hemi-slings of the PRM were scored separately with 0=normal, 1=<50% abnormal and 2=>50% abnormal. The bilateral scores were added giving a maximum total score of 4. The PRM abnormality was then graded as follows: grade 0 = normal (score 0), grade 1 = minor abnormality (scores of 1 and 2) and grade 2 = major abnormality (scores of 3 and 4). To assess the levator ani (PRM) function with vaginal manometry we utilized a water-perfused sleeve sensor, which measured the maximal pressure along the length of the sleeve. The 5mm diameter sleeve was then mounted on progressively larger probes (10, 20, 30 mm) to assess the length-tension relationship of the levator ani muscles. The measurements were performed at rest and during a sustained squeeze at each probe size. The sleeve sensor was oriented with the sensing surface facing the posterior vaginal wall along the midline. Measurements were recorded in mmHg with atmospheric pressure used as reference. The statistical analysis was done with t-test, Mann-Whitney U and chi-square (SPSS 11.5).

Results
Table I: The two groups characteristics

Groups Characteristics	**Parous controls (n=20)**	**FI patients (n=25)**	**p-value**
Age (years±SD)	51.8±10.1	52.8±12.0	0.8*
BMI (kg/m^2±SD)	26.1±4.4	26.9±5.6	0.6*
Vaginal births Mean ± SD	2.2±1.1	1.6±1.2	0.09*
Median, range	2 (1-5)	2 (0-4)	0.17^
FISI [1]	0.5±1.4	38.4±8.6	<0.0001*
UDI-6 [3]	1.2±1.7	6.4±5.4	0.0002*
IIQ-7 [3]	0.1±0.5	7.4±7	<0.0001*

*Independent two-group Student t-test (two-sided)
^Mann Whitney U

Table II: The pelvic floor hiatus anterior-posterior length (APL) in the two groups

Groups	APL rest (cm) Mean ± SD	APL squeeze (cm) Mean ± SD	APL delta (cm)^ Median (25-75%ile)	APL % change[§] Median (25-75%ile)
Controls (n=20)	6.1 ± 0.7	5.4 ± 0.8	0.6 (0.4-1)	9.2 (6.7-18.7)
FI patients (n=25)	6.1±0.5	5.7±0.5	0.45 (0.1-0.8)	7.5 (1.8-12.1)
p-value	1*	0.16*	0.1**	0.13**

^APL delta – difference between rest and squeeze anterior-posterior measurements
[§]APL % change – APL delta divided by the APL rest multiplied by 100%
*Independent two-group t-test (two-sided)
**Mann-Whitney U two-sided p-value

Table III: The puborectalis muscle grading in two groups

PRM Grade	Grade 0	Grade 1	Grade 2	Total minor and major

Controls (n=19)	9 (47%)	6 (32%)	4 (21%)	10 (53%)*
FI patients (n=25)	7 (28%)	8 (32%)	10 (40%)	18 (72%)*

*p value (Chi-square, two-sided) = 0.19

Table IV: Posterior vaginal pressures in mmHg in the two groups by probe size

Probe size	**5mm**		**10mm**		**20mm**		**30mm**	
	rest	squeeze	rest	squeeze	rest	squeeze	rest	squeeze
Controls N=20*	5 (4-10) n=19	23 (16-34) n=19	12 (8-16) n=20	39 (30-50) n=20	30 (17-38) n=20	120 (60-158) n=20	30 (19-61) n=16	145 (62-207) n=16
FI N=25*	8 (3-18) n=13	17 (10-34) n=13	13 (7-17) n=14	28 (21-41) n=14	24 (19-28) n=15	70 (55-87) n=15	38 (7-54) n=11	98 (29-119) n=11
p-value^	0.90	0.30	0.67	0.15	0.39	**0.04**	0.69	0.08

*Median (95% Lower – Upper Confidence Limits of Median)
^Mann Whitney U two-sided p-value

Interpretation of results

The fecal incontinence group had a 19% point difference in the rate of imaged PRM abnormalities compared to vaginally parous women. If the trends in the ultrasound finding persisted, 100 subjects per group would be needed to achieve 80% power for this to be a significant difference. We found that the patients with FI had significantly lower vaginal pressures during a pelvic floor contraction with a 20mm probe and a trend for reduced contraction pressures for all other probe sizes.

Concluding message

Our data suggests that FI is likely associated with defects in the puborectalis muscle anatomy and function.

References

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HUMAN SUBJECTS: This study was approved by the Institutional Review Board at University of California, San Diego and followed the Declaration of Helsinki Informed consent was obtained from the patients.